U. S. DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN No. 96.

Raising Sheep for Mutton.

BY

CHARLES F. CURTISS,
Director of the Iowa Agricultural Experiment Station.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1899.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., April 25, 1899.

SIR: I have the honor to transmit herewith for publication as a Farmers' Bulletin an article on Raising Sheep for Mutton, submitted by the author, Prof. C. F. Curtiss, director of the Iowa Agricultural Experiment Station, in accordance with your instructions.

Very respectfully,

D. E. SALMON, *Chief.*

Hon. JAMES WILSON,
Secretary of Agriculture.

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RAISING SHEEP FOR MUTTON.

INTRODUCTION.

Sheep are associated with man in the earliest records of the human race. They were first used only for milk and later the skins were used for clothing. Nearly a century and a half have elapsed since Robert Bakewell of Dishley, Loughborough, England, began the first systematic and intelligent improvement of mutton sheep. Prior to that time wool had been the primary consideration in sheep raising.

Spain, the home of the Merino, at one time controlled the wool markets of the world, and in the early management of the Spanish Merino the ewes were so small that it was common to kill half the lambs in order that those remaining might go to two ewes. The fleece was practically the only consideration in the sheep reared in that country, and this has been the distinguishing characteristic of the Merino breed until within the present decade. As late as 1892 Mr. J. H. McKibbon, of Albion, Iowa, exhibited a yearling American Merino at the Iowa Sheep Breeders' shearing meeting that yielded a 15-pound fleece from a 54-pound carcass; and even in England, the home of the mutton sheep, we find the following supplication publicly recorded in an early day:

> May God lend his helping aid
> To Keswick and its woolen trade.

Bakewell's work marks the beginning of a new era in sheep raising in Great Britain. His achievements in the practical and scientific improvement of live stock and the consequent increased value and profit in farm animals entitle him to take rank with the greatest benefactors of humanity. Bakewell's contemporaries credit him as being a man of such analytical and systematic methods, such force of intellect and creative genius, that he would have been eminent in any field of labor or undertaking. The problems connected with live-stock production are even more intricate at the present time and the conditions in agriculture more exacting. Good animals never come by chance or haphazard methods; they have been the product of a high degree of intelligence, skill, and intellectual ability. This field will always be worthy of the best minds and highest talent the world affords. The mutton sheep has been slow in invading America. Here, as in Europe, the wool-producing Merino held almost undisputed sway for many years. Fabulous prices prevailed for sheep having no adaptation whatever to anything except wool production.

INCREASING DEMAND FOR GOOD MUTTON.

The American people have been characterized as a nation of pork eaters and pork producers, with little or no appreciation of good mutton. However this may have been in the past, the conditions are rapidly changing. Perhaps the recent depression in the price of wool is largely accountable for the readjustment and changed condition; at any rate, there is a constantly increasing demand for good mutton in the United States. The Chicago market alone in 1894 took nearly a million more mutton sheep than during any previous year, and the receipts during 1898 are the largest on record.[1] Notwithstanding the impetus of increased demand and good prices and the rapidly increasing population, the number of sheep in the United States is considerably lower than in former years. The average of the numbers on hand each year, January 1, from 1891 to 1895 inclusive, was 44,448,885, and the average of the number on hand January 1, from 1896 to 1899 inclusive, was 37,972,212.[2] During the former period two Canadian provinces, Quebec and Ontario, sent to our markets 1,524,046 head of sheep, valued at nearly $5,000,000. This importation of mutton sheep from Canada still continues, notwithstanding the fact that a heavy duty is imposed, and that Canadian mutton is also made on higher-priced feeds and lands than prevail in our own country. During the past year the number of sheep imported at Buffalo alone was 175,697, valued at $574,882. We have also been importing twenty-five to thirty million dollars' worth of wool annually during recent years.

SHEEP PRODUCTION AS A FEATURE OF AMERICAN AGRICULTURE.

The production of prime mutton for American and European markets is rapidly becoming a permanently established industry of vast proportions in the United States. Our rich lands and abundant feeds are well suited to the economical production of superior mutton, and it has been clearly demonstrated that mutton sheep properly selected can grow a large part, if not all, of the wool demanded for American manufacturing. The erroneous impression has prevailed that sheep are only suited to inferior lands. No greater error can be imagined. While it is true that sheep are well adapted to scanty vegetation and capable of profitably grazing semiarid lands, they also render as large returns for a liberal ration of good feeds as any domestic animal, with the possible exception of the hog. The high-priced agricultural lands of Great Britain sustain 680 sheep per thousand acres, and Scotland in 1893 had even as high as 1,380 sheep per thousand acres of agricultural lands.[3] The leading agricultural States of the Union have not to exceed 25 sheep per thousand acres of land.

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[1] Live Stock Report, January 5, 1899.

[2] Statistics of the United States Department of Agriculture.

[3] Sheep, Breeds and Management, by John Wrightson, London.

The seven States constituting the corn-belt area of the United States produced over a billion bushels of corn and 237,000,000 bushels of oats in 1896.[1] The annual production of these crops ranges nearly as great; in 1897 the aggregate corn product was about the same, and the oat crop amounted to 372,000,000 bushels. A large part of this product is obliged to seek a market abroad, and there is not always a profitable cash market for these surplus grains. This has been particularly true during the recent years of low-priced corn, but during all that time there has been a possibility of realizing returns equivalent to 40 or 50 cents a bushel for corn fed to good mutton sheep. There are also some other considerations worth noting. The sale of $1,000 worth of corn at present prices takes from the soil producing the crop about $300 worth of fertility; that is, it takes materials for which the owner of the land would have to pay this amount if he were obliged to purchase commercial fertilizers at the rates usually prevailing in the market, but the same amount of corn can be converted into good mutton and sold at an advanced price and it will take from the land not to exceed $50 worth of fertility, or if sold in the form of wool it will not take from the land over $2 or $3 worth of fertility. It will be incomparably better for American farming and for our system of agriculture to convert the surplus grain products into prime meats to the extent at least of supplying home demands, and then find foreign markets for the condensed and high-priced meat products rather than export the corn and other grains as such.

During the recent years of contraction, as indicated by the figures already quoted, the market for good mutton has been continually expanding, and the experience of every successful sheep raiser in any section of the United States emphatically refutes the doctrine that any of our lands are too valuable for mutton production.

MUTTON THE PRIMARY CONSIDERATION.

Notwithstanding this apparent contraction of our flocks the sheep industry has made substantial progress. It has been established on a more permanent and lasting basis by making mutton the primary consideration and wool incidental, instead of the reverse, as has generally been the case heretofore. On this basis, sheep raising will return a satisfactory profit one year with another, independent of the price of wool, or nearly so, as it has been clearly demonstrated that it does not cost any more, if even as much, to produce a pound of mutton from good mutton sheep under average farm conditions than to produce a pound of beef, when the wool is left entirely out of consideration; and the wool always has some value; it seldom goes so low that well-bred mutton sheep will not yield a fleece worth from 75 cents to $1.50.

[1] Statistics of the United States Department of Agriculture.

Large numbers of sheep have been fattened annually in the grain-producing States the past few years, and many important truths and fundamental facts pertaining to this industry have been established. These all tend to place sheep raising on a more permanent basis. Practical feeders and farmers have found that there is no more profitable outlet for surplus grain products, particularly after the country has suffered from the ravages of hog cholera, than in mutton production.

INVESTIGATIONS AT THE EXPERIMENT STATIONS.

Many careful and scientific investigations have been conducted at the experiment stations, which also shed new light on the problems of sheep feeding. Some of these are extracted for these pages on account of the lessons of general interest they contain.

PLAN OF EXPERIMENTS.

The investigation of this subject was taken up at the Iowa Experiment Station when the depression in the sheep business had reached its lowest point. The primary object was to determine the relative economy of production and value of mutton and wool compared with other farm products, and incidentally to derive information concerning the demands of the market for these products and the adaptation of some of the leading breeds to meet the market requirements. The experiment planned for this purpose consisted in using ten carefully selected representatives each of ten of the leading breeds of sheep to be used in a feeding experiment covering a period of about one hundred days, taking the lambs at weaning time, or soon afterwards, and finishing them for market in prime condition, carefully determining the cost of producing a pound of mutton from each breed and the average weight of fleece, and the value of both mutton and wool on the market. This was followed by a thorough and exhaustive slaughter and block test giving the weight and value of various parts of the carcasses, and a photograph of the leading cuts on the block. The investigation covered a period of two years in order to insure greater accuracy, and the results were found to be substantially uniform in the two trials.

The breeds included Southdown, Shropshire, Oxford, Suffolk, Lincoln, Leicester, Cotswold, Dorset, Merino, Merino and Shropshire cross, and Shropshire ewes. The first experiment covered a feeding period of ninety days and the second one hundred and six days. Three representative lambs from each lot were photographed near the close of each experiment. The photographs were taken in such position as to show front quartering, side, and rear quarter views of each breed, and reproduced in groups. The reproductions are quite free from exaggerations and show the lambs just as they were taken by the camera, the object in reproducing them being to combine the three views in one illustration. The characteristics and quality of the several breeds are accurately represented by the figures appearing in the following pages, and the record and summary of feeding made by the representatives of each breed are given in condensed form.

In the second experiment the Rambouillets were used instead of the National Delaine Merinos, in order to afford a comparison of another family of Merinos; and the Shropshire-Merino crossbreds were also omitted from the second experiment and a bunch of pure-bred Shropshire ewe lambs similar to the Shropshire wethers was included for the purpose of comparing the feeding and mutton qualities of ewes and wethers of the same breed.

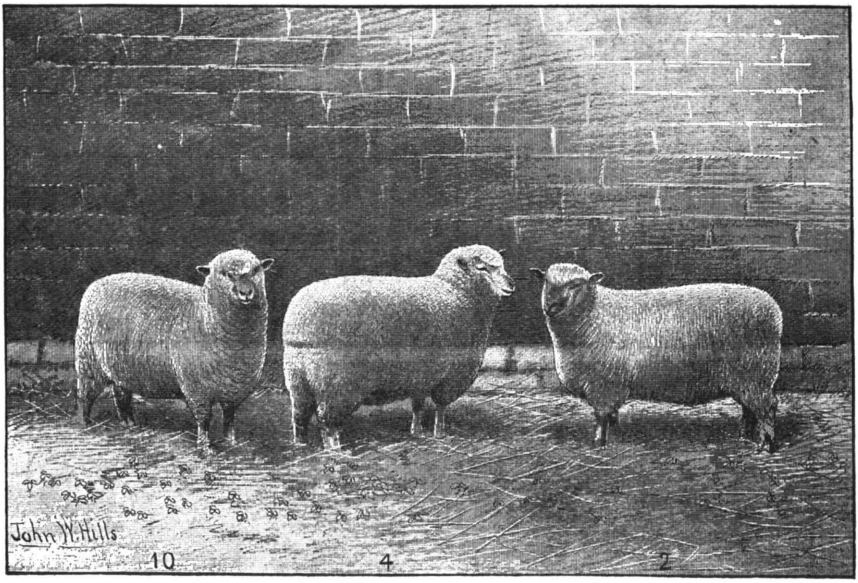

FIG. 1.—Three representative Southdowns.

Record of breed.

Data relating to the experiments.	First experiment.	Second experiment.
Average age of the lambs.....days..	374	289
Average weight (March 31, shorn).....pounds..	125	*a* 102.4
Time occupied in feeding experiments.....days..	90	106
Average gain per day during the experiment.....pound..	.45	.35
Average dry matter fed per pound of gain.....pounds..	7.38	9.89
Average cost of feed per pound of gain.....cents..	2.93	3.12
Selling price on Chicago market per cwt.....dollars..	4.75	5.75
Average yield of dressed mutton.....per cent..	55.4	55.26
Average weight of fleece.....pounds..	6.75	4.59
Average age of fleece.....days..	366	289
Average value of fleece.....cents..	75	64
Average yearly weight of fleece.....pounds..	6.75	5.79
Average yearly value of fleece.....cents..	75	81
Average weight of wool per 1,000 pounds, live weight....pounds..	54	44.8
Average value of wool per 1,000 pounds, live weight.....dollars..	6.03	6.27
Value of wool per pound in natural condition.....cents..	11½	14
Average shrinkage in scouring.....per cent..	54¼	.....
Value of wool per pound in scoured condition.....cents..	26	.....

a Sold January 1.

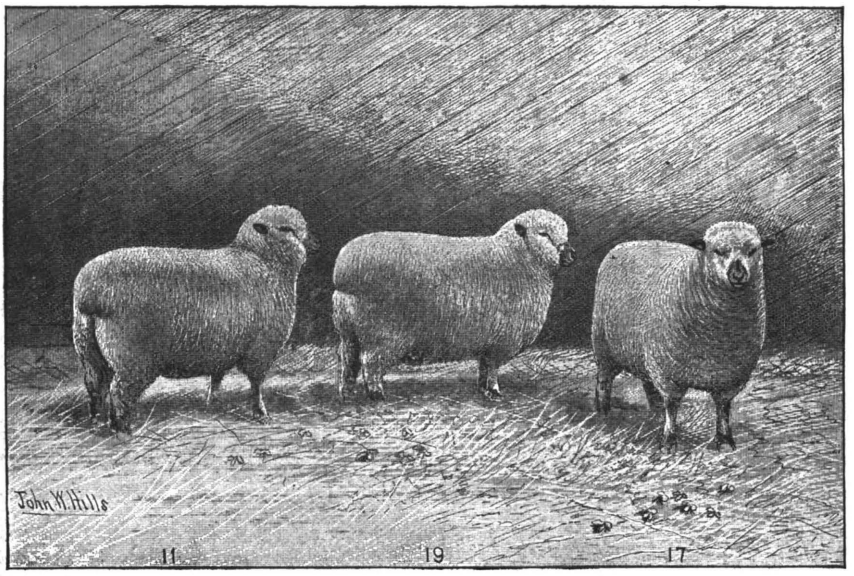

FIG. 2.—Three representative Shropshires.

Record of breed.

Data relating to the experiments.	First experiment.	Second experiment.
Average age of lambs.....days..	371	279
Average weight of lambs (March 31, shorn).....pounds..	135	*a* 126
Time occupied in feeding experiments.....days..	90	106
Average gain per day during the experiment.....pound..	.48	.36
Average dry matter fed per pound of gain.....pounds..	7.18	10.26
Average cost of feed per pound of gain.....cents..	2.88	3.21
Selling price on Chicago market per cwt.....dollars..	4.625	5.60
Average yield of dressed mutton.....per cent..	56.3	52.88
Average weight of fleece.....pounds..	8.75	7.83
Average age of fleece.....days..	363	279
Average value of fleece.....dollars..	0.98	1.10
Average yearly weight of fleece.....pounds..	8.75	10.22
Average yearly value of fleece.....dollars..	0.98	1.44
Average weight of wool per 1,000 pounds of live weight..pounds..	64.86	62.1
Average value of wool per 1,000 pounds of live weight...dollars..	7.23	8.69
Value of wool per pound in natural condition.....cents..	11	14
Average shrinkage in scouring.....per cent..	56¼	.....
Value of wool per pound in scoured condition.....cents..	25	.....

a Sold January 1.

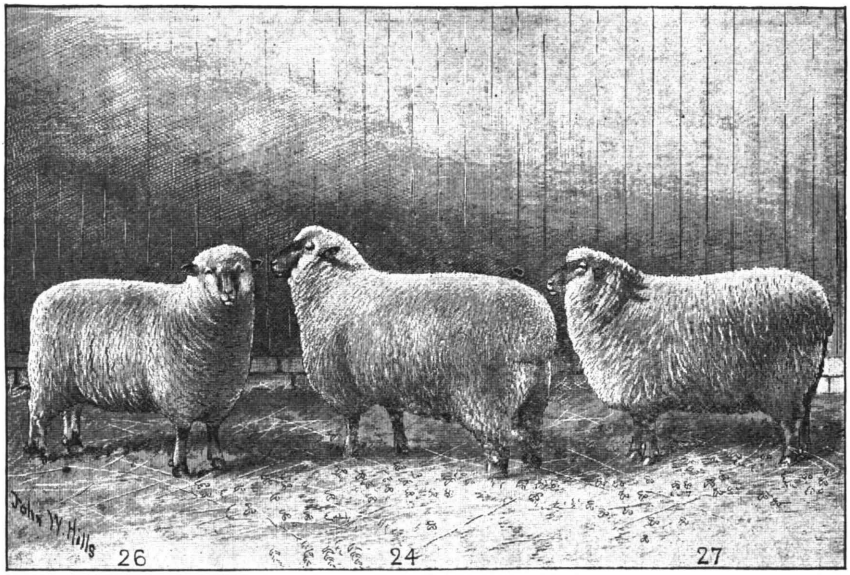

FIG. 3.—Three representative Oxfords.

Record of breed.

Data relating to the experiments.	First experiment.	Second experiment.
Average age of lambs ..... days..	374	279
Average weight (March 31, shorn) ..... pounds..	155	a136.7
Time occupied in feeding experiments ..... days..	90	106
Average gain per day during the experiment ..... pound..	.52	.40
Average dry matter fed per pound gain ..... pounds..	7.40	10.31
Average cost of feed per pound of gain ..... cents..	3.03	3.22
Selling price on Chicago market per cwt ..... dollars..	4.50	5.40
Average yield of dressed mutton ..... per cent..	55.2	50.08
Average weight of fleece ..... pounds..	10.95	8.03
Average age of fleece ..... days..	365	279
Average value of fleece ..... dollars..	1.44	1.16
Average yearly weight of fleece ..... pounds..	10.95	9.38
Average yearly value of fleece ..... dollars..	1.44	1.51
Average weight of wool per 1,000 pounds of live weight.. pounds..	70.5	62.40
Average value of wool per 1,000 pounds of live weight.... dollars..	9.27	9.01
Value of wool per pound in natural condition ..... cents..	12¾	14½
Average shrinkage in scouring ..... per cent..	47	.....
Value of wool per pound in scoured condition ..... cents..	24	.....

a Sold January 1.

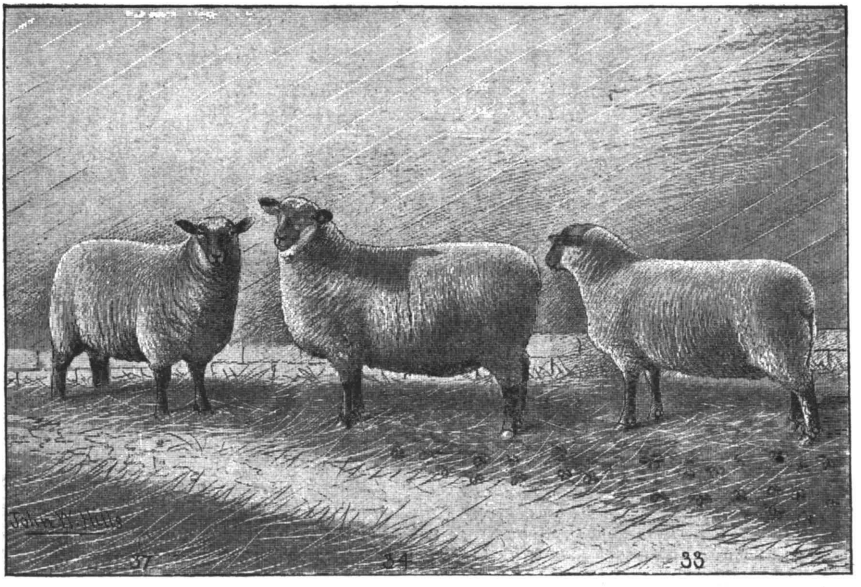

FIG. 4.—Three representative Suffolks.

Record of breed.

Data relating to the experiments.	First experiment.	Second experiment.
Average age of lambs.....days..	394	285
Average weight (March 31, shorn).....pounds..	159	*a* 134.4
Time occupied in feeding experiments.....days..	90	106
Average gain per day during the experiment.....pound..	.55	.40
Average dry matter fed per pound of gain.....pounds..	7.40	10.36
Average cost of feed per pound of gain.....cents..	2.95	3.44
Selling price on Chicago market per cwt.....dollars..	4.25	5.00
Average yield of dressed mutton.....per cent..	53.6	52.54
Average weight of fleece.....pounds..	7.65	5.20
Average age of fleece.....days..	383	285
Average value of fleece.....cents..	86	75
Average yearly weight of fleece.....pounds..	7.29	6.64
Average yearly value of fleece.....cents..	82	95
Average weight of wool per 1,000 pounds of live weight...pounds..	48.26	40.24
Average value of wool per 1,000 pounds of live weight...dollars..	5.45	5.80
Value of wool per pound in natural condition.....cents..	11	14½
Average shrinkage in scouring.....per cent..	54½	.....
Value of wool per pound in scoured condition.....cents..	24	.....

a Sold January 1.

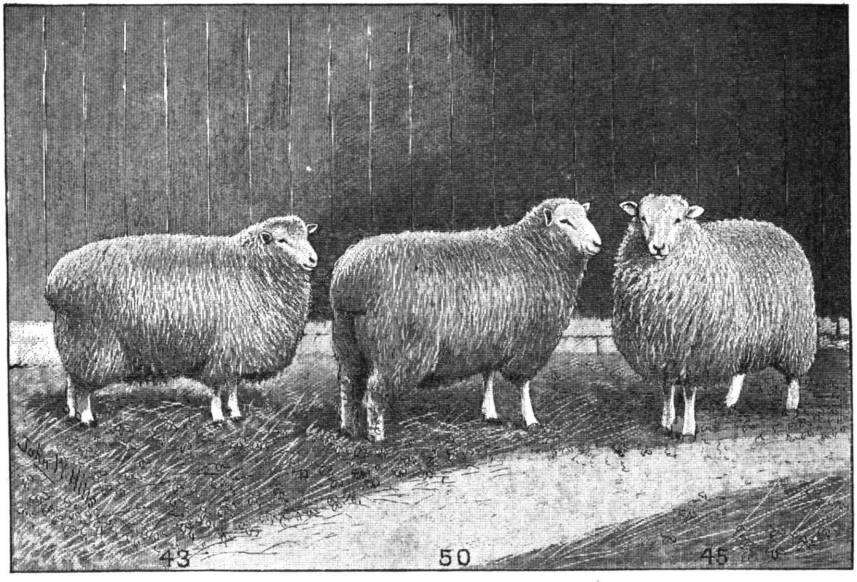

FIG. 5.—Three representative Lincolns.

Record of breed.

Data relating to the experiments.	First experiment.	Second experiment.
Average age of lambs.....days..	345	291
Average weight (March 31, shorn).....pounds..	158	*a* 143.5
Time occupied in feeding experiments.....days..	90	106
Average gain per day during the experiment.....pound..	.55	.46
Average dry matter fed per pound of gain.....pounds..	7.29	9.1
Average cost of feed per pound of gain.....cents..	2.89	2.86
Selling price on the Chicago market per cwt.....dollars..	4.50	5.25
Average yield of dressed mutton.....per cent..	55.7	51.08
Average weight of fleece.....pounds..	12.85	10.4
Average age of fleece.....days..	332	291
Average value of fleece.....dollars..	1.79	1.56
Average yearly weight of fleece.....pounds..	14.13	13.03
Average yearly value of fleece.....dollars..	1.96	1.95
Average weight of wool per 1,000 pounds of live weight..pounds..	81.48	78.13
Average value of wool per 1,000 pounds of live weight....dollars..	11.37	11.72
Value of wool per pound in natural condition.....cents..	13¾	15
Average shrinkage in scouring.....per cent..	40	.....
Value of wool per pound in scoured condition.....cents..	23	.....

a Sold January 1.

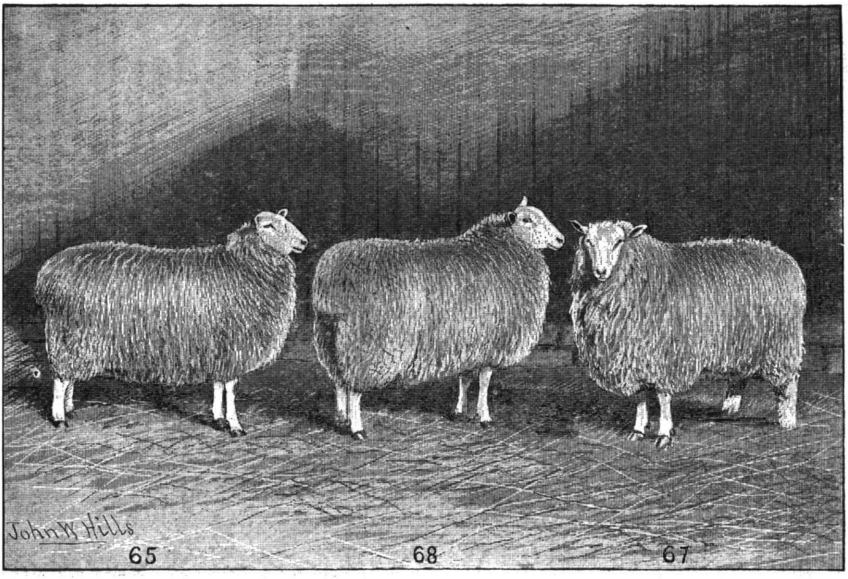

FIG. 6.—Three representative Leicesters.

Record of breed.

Data relating to the experiments.	First experiment.	Second experiment.
Average age of lambs ..... days..	362	277
Average weight (March 31, shorn) ..... pounds..	167	*a* 133
Time occupied in feeding experiments ..... days..	90	106
Average gain per day during the experiment ..... pound..	.52	.44
Average dry matter fed per pound of gain ..... pounds..	7.49	9.34
Average cost of feed per pound of gain ..... cents..	2.93	2.93
Selling price on Chicago market per cwt ..... dollars..	4.50	5.25
Average yield of dressed mutton ..... per cent..	57.8	51.87
Average weight of fleece ..... pounds..	11.55	8.9
Average age of fleece ..... days..	348	277
Average value of fleece ..... dollars..	1.76	1.33
Average yearly weight of fleece ..... pounds..	12.11	11.71
Average yearly value of fleece ..... dollars..	1.85	1.71
Average weight of wool per 1,000 pounds of live weight .. pounds..	70	71.71
Average value of wool per 1,000 pounds of live weight .... dollars..	10.52	10.71
Value of wool per pound in natural condition ..... cents..	14¾	15
Average shrinkage in scouring ..... per cent..	38½	.....
Value of wool per pound in scoured condition ..... cents..	24	.....

a Sold January 1.

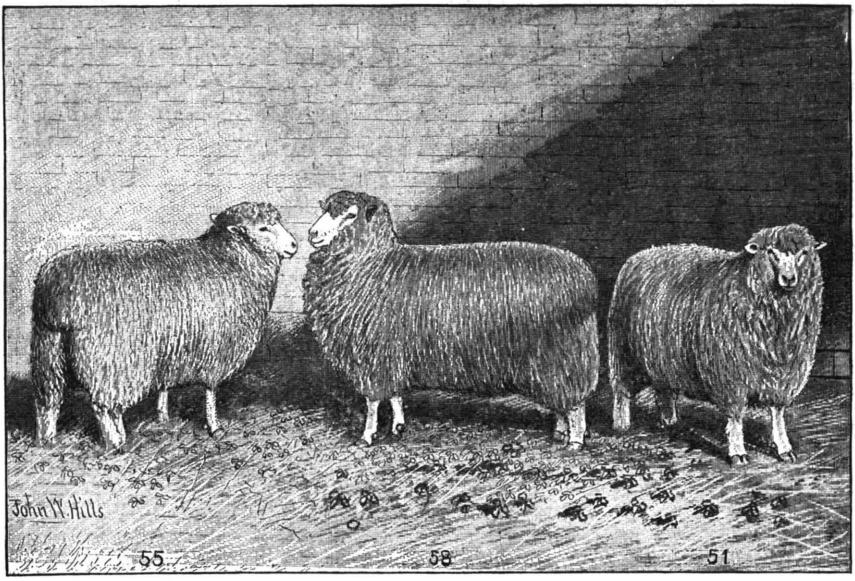

FIG. 7.—Three representative Cotswolds.

Record of breed.

Data relating to the experiments.	First experiment.	Second experiment.
Average age of lambs.....days..	347	268
Average weight (March 31, shorn).....pounds..	161	*a* 138.4
Time occupied in feeding experiments.....days..	90	106
Average gain per day during the experiment.....pound..	.62	.50
Average dry matter fed per pound of gain.....pounds..	6.53	8.48
Average cost of feed per pound of gain.....cents..	2.60	2.65
Selling price on Chicago market per cwt.....dollars..	4.50	5.25
Average yield of dressed mutton.....per cent..	54.9	53.57
Average weight of fleece.....pounds..	12.65	9.8
Average age of fleece.....days..	334	268
Average value of fleece.....dollars..	1.66	1.46
Average yearly weight of fleece.....pounds..	13.82	13.32
Average yearly value of fleece.....dollars..	1.81	1.98
Average weight of wool per 1,000 pounds of live weight..pounds..	78.42	76.20
Average value of wool per 1,000 pounds of live weight....dollars..	10.26	11.35
Value of wool per pound in natural condition.....cents..	13	15
Average shrinkage in scouring.....per cent..	43⅓	.....
Value of wool per pound in scoured condition.....cents..	23	.....

a Sold January 1.

FIG. 8.—Three representative Dorsets.

Record of breed.

Data relating to the experiments.	First experiment.	Second experiment.
Average age of lambs ..... days..	367	277
Average weight (March 31, shorn) ..... pounds..	138	a 128.3
Time occupied in feeding experiments ..... days..	90	106
Average gain per day during the experiment ..... pound..	.48	.43
Average dry matter fed per pound of gain ..... pounds..	7.85	9.89
Average cost of feed per pound of gain ..... cents..	3.05	3.04
Selling price on Chicago market per cwt ..... dollars..	3.75	5.50
Average yield dressed mutton ..... per cent..	52.6	54.11
Average weight of fleece ..... pounds..	6.83	5.97
Average age of fleece ..... days..	355	277
Average value of fleece ..... cents..	77	83
Average yearly weight of fleece ..... pounds..	7.2	7.84
Average yearly value of fleece ..... dollars..	79	1.09
Average weight of wool per 1,000 pounds of live weight .. pounds..	49.56	48.8
Average value of wool per 1,000 pounds of live weight .... dollars..	5.57	6.80
Value of wool per pound in natural condition ..... cents..	10¾	14
Average shrinkage in scouring ..... per cent..	55¼	.....
Value of wool per pound in scoured condition ..... cents..	24	.....

a Sold January 1.

FIG. 9.—Three representative National Delaines.

Record of breed.

Data relating to the experiment.		First experiment.
Average age of lambs	days	362
Average weight (March 31, shorn)	pounds	99
Time occupied in feeding experiment	days	90
Average gain per day during the experiment	pound	.29
Average dry matter fed per pound gain	pounds	9.35
Average cost of feed per pound of gain	cents	3.78
Selling price on Chicago market per cwt	dollars	4.25
Average yield of dressed mutton	per cent	51.8
Average weight of fleece	pounds	9.9
Average age of fleece	days	359
Average value of fleece	dollars	1.00
Average yearly weight of fleece	pounds	10.07
Average yearly value of fleece	dollars	1.02
Average weight of wool per 1,000 pounds of live weight	pounds	100.43
Average value of wool per 1,000 pounds of live weight	dollars	10.16
Value of wool per pound in natural condition	cents	9¾
Average shrinkage in scouring	per cent	67½
Value of wool per pound in scoured condition	cents	30

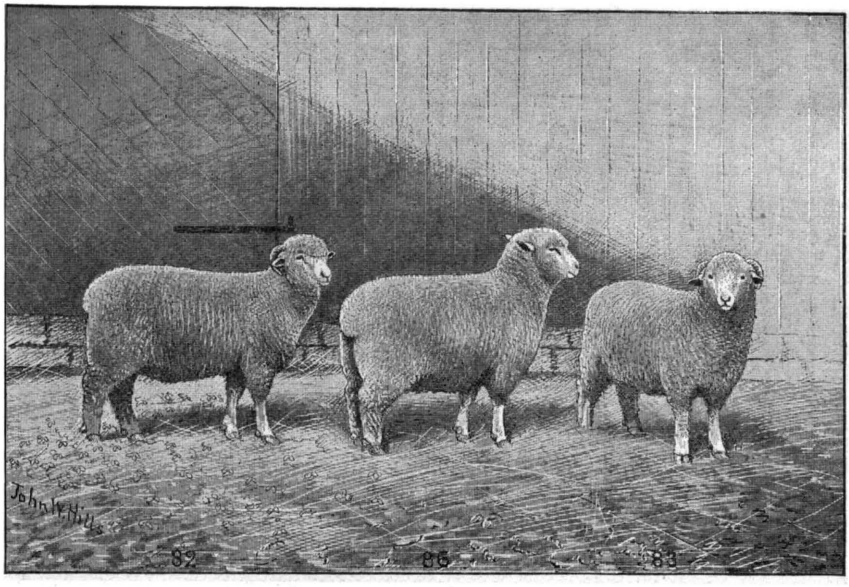

FIG. 10.—Three representative Rambouillets (French-Merinos).

Record of breed.

Data relating to the experiment.	Second experiment.
Average age of lambs ..... days..	255
Average weight ..... pounds..	*a* 113.3
Time occupied in feeding experiment ..... days..	106
Average gain per day during the experiment ..... pound .	.37
Average dry matter fed per pound of gain ..... pounds..	10.29
Average cost of feed per pound of gain ..... cents..	2.91
Selling price on Chicago market per cwt ..... dollars..	5.00
Average yield of dressed mutton ..... per cent..	49.57
Average weight of fleece ..... pounds..	6.60
Average age of fleece ..... days..	255
Average value of fleece ..... cents..	73
Average yearly weight of fleece ..... pounds..	9.42
Average yearly value of fleece ..... dollars..	1.04
Average weight of wool per 1,000 pounds of live weight ..... pounds..	61.85
Average value of wool per 1,000 pounds of live weight ..... dollars..	6.84
Value of wool per pound in natural condition ..... cents..	11

a Sold January 1.

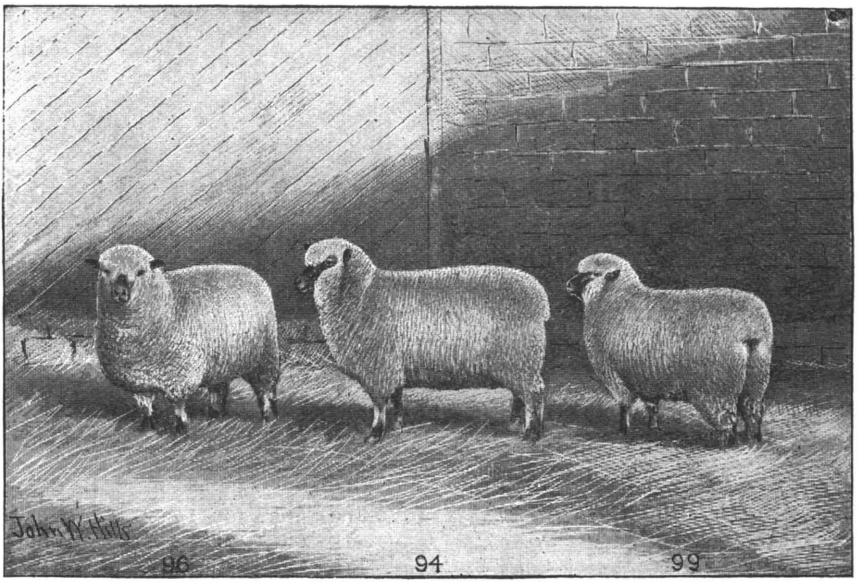

FIG. 11.—Three representative Shropshire ewes.

Record of breed.

Data relating to the experiment.	Second experiment.
Average age of lambs.....days..	255
Average weight.....pounds..	*a* 100
Time occupied in feeding experiment.....days..	106
Average gain per day during the experiment.....pound..	.31
Average dry matter fed per pound of gain.....pounds..	10.30
Average cost of feed per pound of gain.....cents..	3.18
Selling price on Chicago market per cwt.....dollars..	5.65
Average yield of dressed mutton.....per cent..	54.55

a Sold January 1.

FIG. 12.—Three representative Shropshire-Merino crossbreds.

Record of breed.

Data relating to the experiment.	First experiment.
Average age of the lambs ..... days..	346
Average weight (March 31, shorn) ..... pounds..	111
Time occupied in feeding experiment ..... days..	90
Average gain per day during the experiment ..... pound..	.41
Average dry matter fed per pound of gain ..... pounds..	7.02
Average cost of feed per pound of gain ..... cents..	2.82
Selling price on Chicago market per cwt ..... dollars..	4.50
Average yield of dressed mutton ..... per cent..	53.7
Average weight of fleece ..... pounds..	7.5
Average age of fleece ..... days..	334
Average value of fleece ..... cents..	90
Average yearly weight of fleece ..... pounds..	8.2
Average yearly value of fleece ..... cents..	98
Average weight of wool per 1,000 pounds live weight ..... pounds..	67.87
Average value of wool per 1,000 pounds live weight ..... dollars..	8.15
Value of wool per pound in natural condition ..... cents..	11¾
Average shrinkage in scouring ..... per cent..	53
Value of wool per pound in scoured condition ..... cents..	25

In computing the cost of gain the feeds used were estimated at the following prices, based on the commercial values prevailing in the local market during this investigation:

Feed.		First experiment.	Second experiment.
Bran	per cwt.	$0.40	$0.35
Oats	do	.40	.35
Shelled corn	do	.28½	.20
Oil meal	do	.90	.90
Hay	do	.28	.20
Roots	do	.05	.05
Cabbage	do	.....	.10

The feeding record presented in the following pages gives the total amount of feed consumed by each breed during both experiments and the gains and cost of making a pound of mutton. The number of pounds of dry matter required for a pound of gain are also shown. This determination is made in order to afford a uniform basis for comparison, as all farm feeds, no matter how completely air dried, contain more or less water, ranging from about 11 per cent in corn and oats to as high as 90 per cent in mangels and turnips. The records of the first and second experiments are presented separately, and the average results of both experiments are included with the record of the second in order to furnish more complete data for comparison.

It will be seen that the ration varies considerably at the beginning and end of the experiments owing to the fact that the lambs were on a light feed of grain and a heavy feed of hay at the outset, and the grain ration given at the beginning consisted principally of bran and oats, and the shelled corn and oil meal were added as the feeding advanced. This is a necessary precaution in getting lambs or sheep on to feed, as they do not take to a concentrated grain ration readily at the beginning.

Complete feeding record for all breeds in first experiment.

	Shelled corn.	Oats.	Bran.	Oil meal.	Turnips.	Mangels.	Clover hay.	Pea hay.	Timothy hay.	Total gain.	Gain per head daily (average).	Total dry matter.	Pounds of dry matter per pound of gain (average).	Total cost of feed.	Cost of feed per pound of gain (average).
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*			*Cents.*
10 Southdown lambs.. January	237	238	47	47	99	170	348	124	12	135	.43	950.7	7.04	$3.73	2.8
10 Southdown lambs.. February	254	254	32	63	.....	261	460	40	.....	125	.43	993.5	7.95	3.97	3.18
10 Southdown lambs.. March	260	261	32	64	.....	204	557	.....	.....	145.5	.48	1,046	7.21	4.14	2.48
Southdown totals and averages..	751	753	111	174	99	635	1,365	164	12	405.5	.45	2,990.2	7.38	11.84	2.93
10 Shropshire lambs.. January	249	247	50	49	112	167	328	124	12	123	.39	957.7	7.78	3.78	3.7
10 Shropshire lambs.. February	273	273	34	68	.....	269	455	40	.....	136	.46	1,030.4	7.57	4.14	3.4
10 Shropshire lambs.. March	286	287	36	72	.....	234	564	.....	.....	170.5	.56	1,093.6	6.43	4.45	2.61
Shropshire totals and averages..	808	807	120	189	112	670	1,347	164	12	429.5	.48	3,081.7	7.18	12.37	2.88
10 Oxford lambs..... January	288	288	57	56	115	193	419	124	14	167	.54	1,123.5	6.72	4.42	2.64
10 Oxford lambs..... February	311	312	39	78	.....	299	548	40	.....	131	.45	1,194.8	9.12	4.79	3.66
10 Oxford lambs..... March	332	333	41	82	.....	293	646	.....	.....	174.5	.58	1,284.2	7.38	5.10	2.92
Oxford totals and averages.....	931	933	137	216	115	985	1,613	164	14	472.5	.52	3,602.5	7.40	14.31	3.03
10 Suffolk lambs..... January	294	295	59	59	121	186	439	124	14	181	.58	1,144.1	6.32	4.55	2.51
10 Suffolk lambs..... February	321	321	40	80	.....	299	561	40	.....	143	.49	1,225.4	8.56	4.91	3.43
10 Suffolk lambs..... March	335	335	42	84	.....	294	654	.....	.....	172.5	.58	1,298.3	7.55	5.20	3.01
Suffolk totals and averages.....	950	951	141	223	121	779	1,654	164	14	496.5	.55	3,667.8	7.40	14.66	2.95
10 Lincoln lambs..... January	280	282	57	56	115	193	445	124	16	142	.46	1,134.8	7.99	4.45	3.13
10 Lincoln lambs..... February	310	310	39	77	.....	299	571	40	.....	155	.53	1,210.7	7.81	4.83	3.12
10 Lincoln lambs..... March	338	338	42	84	.....	294	644	.....	.....	202.5	.68	1,294.1	6.40	5.19	2.55
Lincoln totals and averages, ...	928	930	138	217	115	786	1,660	164	16	499.5	.55	3,639.6	7.29	14.47	2.89
9 Leicester lambs.... January	219	219	50	48	105	171	348	124	12	88	.31	921.9	10.47	3.63	4.12
9 Leicester lambs.... February	274	274	34	69	.....	271	508	40	.....	160	.61	1,078.2	6.74	4.30	2.70
9 Leicester lambs.... March	300	300	38	76	.....	364	587	.....	.....	176	.65	1,176.3	6.68	4.62	2.62
Liecester totals and averages	793	793	122	193	105	806	1,443	164	12	424	.52	3,176.4	7.49	12.55	2.93

10 Cotswold lambs	January	280	282	57	56	127	181	447	123	16	155	.50	1,135.2	7.32	4.45	2.87
	February	310	310	39	77	.....	299	572	40	.....	183	.63	1,211.5	6.62	4.84	2.64
	March	338	338	42	84	.....	294	646	.....	.....	218.5	.72	1,286.8	5.90	5.20	2.38
Cotswold totals and averages		928	930	138	217	127	774	1,665	163	16	556.5	.62	3,633.5	6.53	14.49	2.60
10 Dorset lambs	January	272	272	53	52	123	184	440	124	15	128	.43	1,106.1	8.64	4.32	3.37
	February	286	287	36	72	.....	299	558	40	.....	130	.45	1,150.5	8.85	4.30	3.31
	March	301	302	38	76	.....	364	572	.....	.....	178	.56	1,166.2	6.55	4.69	2.64
Dorset totals and averages		859	861	127	200	123	847	1,570	164	15	436	.48	3,422.8	7.85	13.31	3.05
10 Merino lambs	January	243	242	47	48	108	170	285	118	10	102	.33	900.8	8.83	3.58	3.51
	February	236	236	29	59	.....	261	284	37	.....	104	.36	803.4	7.72	3.30	3.17
	March	201	200	25	50	.....	204	307	.....	.....	52	.17	708.3	13.62	2.88	5.54
Merino totals and averages		680	678	101	157	108	635	876	155	10	258	.29	2,412.5	9.35	9.76	3.78
10 crossbred lambs	January	243	243	48	48	120	158	295	121	12	132	.43	915.1	6.93	3.36	2.75
	February	239	240	30	60	.....	261	293	32	.....	107	.37	814.6	7.61	3.34	3.12
	March	231	231	29	58	.....	204	417	.....	.....	131	.43	866.7	6.61	3.49	2.66
Crossbred totals and averages		713	714	107	166	120	623	1,005	153	12	370	.41	2,596.4	7.02	10.46	2.82
10 range lambs	January	184	181	36	36	78	119	280	121	11	78	.25	764.4	9.80	2.97	3.38
	February	191	191	24	48	.....	174	345	38	.....	131	.45	751.4	5.73	3.00	2.29
	March	197	198	24	49	.....	136	388	.....	.....	124	.41	762.1	6.14	3.05	2.46
Range totals and averages		572	570	84	133	78	429	1,013	159	11	333	.37	2,277.9	6.84	9.02	2.71
Grand total, all breeds		8,913	8,920	1,326	2,085	1,223	7,769	15,211	1,778	144	4,678	.48	34,501.5	7.37	137.24	2.93
Grand total, first seven breeds		6,089	6,097	907	1,429	794	5,135	10,747	1,147	96	3,281	.53	23,791.9	7.25	94.69	2.88

A full allowance of hay may be given with safety. Bran or other comparatively bulky feeds are well suited to starting sheep on feed, and for the same reason oats is safer than corn.

During the preliminary feeding period, 1 pound of grain is a sufficient allowance for 10 lambs daily; following this the grain ration may be increased to one-quarter of a pound per head, but it should not exceed one-half a pound for native-bred lambs at the end of thirty days. Range lambs will not eat more than one-third to one-half this amount with safety. Hay feeding alone without any grain is sometimes practiced for the first thirty or sixty days in regions where alfalfa is abundant and of good quality, and quite satisfactory gains are thus obtained. It is a serious mistake to attempt to put lambs or sheep onto heavy grain rations suddenly, and one that not infrequently causes serious loss and permanent injury.

During the latter part of this experiment the oats, shelled corn, and oil meal were increased and the lambs crowded to their full capacity. Some of the larger breeds consumed as much as 2¼ pounds of grain per head daily.

COST OF PRODUCING MUTTON.

The summary of the first experiment with the lambs shows that—

One hundred and nine head consumed 34,501 pounds of feed (total dry matter) in ninety days and made a gain of 4,678 pounds.

Seven special mutton breeds consumed 23,792 pounds of feed and gained 3,281 pounds.

This gain is at the rate of 1 pound increase in live weight for each 7.37 pounds of feed (dry matter) by all breeds tested, and 1 pound for each 7.25 by seven special mutton breeds.

Complete feeding record for all breeds in second experiment, and summary of both experiments.

	Shelled corn.	Oats.	Bran.	Oil meal.	Hay.	Cabbage.	Green clover.	Roots.	Total gain.	Gain per head daily (average).	Total dry matter.	Pounds of dry matter per pound of gain (average).	Total cost of feed.	Cost of feed per pound of gain (average).
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*			*Cents.*
10 Southdown lambs—Sept. 16 to 30	64.39	65.92	32.19	.....	259	239	172	.....	55	0.36	436.69	7.94	$1.27	2.30
10 Southdown lambs—October	240.40	240.40	60.20	34.90	585	582	.....	.....	127	.41	1,064.06	8.37	3.69	2.98
10 Southdown lambs—November	248	248	62	43.50	540	294.50	.....	42.50	89	.29	1,046.12	11.75	3.56	4.00
10 Southdown lambs—December	288.25	257.80	49.20	49	533	.....	.....	263	107	.34	1,193.37	11.12	3.28	3.07
Southdown totals and averages	841.04	812.12	203.59	127.40	1,917	1,115.50	172	305.50	378	.35	3,740.24	9.89	11.80	3.12
10 Southdown lambs, first experiment	751	753	111	174	1,541	.....	.....	734	405.5	.45	2,990.20	7.38	11.84	2.93
Summary for the breed, both experiments	1,592.04	1,565.12	314.59	301.40	3,458	.....	.....	1,039.50	783.5	.40	6,730.44	8.59	23.64	3.02
9 Shropshire lambs—Sept. 16 to 30	63.27	64.82	31.63	.....	273.60	24.21	207	.....	59	.43	400.09	6.77	1.08	1.83
9 Shropshire lambs—October	227.18	227.18	56.79	33.16	596.90	579.60	.....	.....	123	.44	1,045.98	8.71	3.44	2.80
9 Shropshire lambs—November	236.68	236.68	59.17	41.42	556	302.50	.....	79.50	82	.30	1,026.10	12.51	3.33	4.06
9 Shropshire lambs—December	281.06	251.36	47.97	38.04	555	.....	.....	274.50	80	.28	1,056.86	13.21	3.20	3.99
Shropshire totals and averages	808.19	780.04	195.56	112.62	1,981.50	1,124.20	207	354	344	.36	3,529.03	10.26	11.05	3.21
10 Shropshire lambs, first experiment	808	807	120	189	1,523	.....	.....	782	429.5	.48	3,081.70	7.18	12.37	2.88
Summary for the breed, both experiments	1,616.19	1,587.04	315.56	301.62	3,504.50	.....	.....	1,136	773.5	.41	6,611.15	8.54	23.42	3.02
9 Oxford lambs—Sept. 16 to 30	69.65	71.39	34.82	.....	315.90	269	243	.....	55	.40	476.40	8.66	1.46	2.67
9 Oxford lambs—October	255.08	255.08	63.77	37.19	693.50	559	.....	.....	148	.53	1,190.40	8.04	3.89	2.73
9 Oxford lambs—November	256.28	256.28	64.07	44.85	659	314	.....	87.50	80	.28	1,156.62	14.45	3.71	4.63
9 Oxford lambs—December	260.12	290.57	50.80	39.43	657	.....	.....	276	104	.37	1,166.33	11.21	3.51	3.38
Oxford totals and averages	841.13	873.32	213.46	121.47	2,324.40	1,142	243	363.50	387	.40	3,989.75	10.31	12.57	3.22
10 Oxford lambs, first experiment	931	933	137	216	1,791	.....	.....	1,100	472.5	.52	3,602.50	7.40	14.31	3.03
Summary for the breed, both experiments	1,772.13	1,806.32	350.46	337.47	4,115.40	.....	.....	1,463.50	859.5	.46	7,592.25	8.83	26.88	3.13

Complete feeding record for all breeds in second experiment, and summary of both experiments—Continued.

	Shelled corn.	Oats.	Bran.	Oil meal	Hay.	Cabbage.	Green clover.	Roots.	Total gain.	Gain per head daily (average).	Total dry matter.	Pounds of dry matter per pound of gain (average).	Total cost of feed.	Cost of feed per pound of gain (average).
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*			*Cents.*
9 Suffolk lambs—Sept. 16 to 30	69.51	71.28	34.75	.....	301.50	269.10	243	.....	63	0.46	508.61	8.05	1.98	3.15
9 Suffolk lambs—October	253	253	63.25	36.82	707.40	648.90	.....	.....	132	.47	1,201.91	9.10	4.00	3.03
9 Suffolk lambs—November	247.16	247.16	61.79	43.25	641.70	127.80	.....	79.65	105	.38	1,106.73	10.44	3.77	3.59
9 Suffolk lambs—December	294.55	263.10	50.05	39.75	648.90	.....	.....	335.70	85	.30	1,171.38	13.78	3.50	4.12
Suffolk totals and averages	864.22	834.54	209.84	119.82	2,299.50	1,045.80	243	415.35	385	.40	3,988.63	10.36	13.25	3.44
10 Suffolk lambs, first experiment	950	951	141	223	1,832	.....	.....	900	496.5	.55	3,667.80	7.40	14.66	2.95
Summary for the breed, both experiments	1,814.22	1,785.54	350.84	342.82	4,131.50	.....	.....	1,315.35	881.5	.47	7,645.42	8.67	27.91	3.16
9 Lincoln lambs—Sept. 16 to 30	69.84	71.64	34.91	.....	275.40	269.10	243	.....	73	.54	486.80	6.67	1.39	1.90
9 Lincoln lambs—October	252.13	252.13	62.88	36.88	696.70	653.90	.....	.....	160	.57	1,191.22	7.44	3.98	2.48
9 Lincoln lambs—November	264.12	264.12	66.03	46.22	659	316	.....	83.50	104	.37	1,175.70	11.30	3.77	3.62
9 Lincoln lambs—December	305.11	273.16	52.31	41.41	655	.....	.....	275.50	107	.38	1,192.48	11.05	3.57	3.33
Lincoln totals and averages	891.20	861.05	216.13	124.51	2,286.10	1,239	243	259	444	.46	4,046.20	9.11	12.71	2.86
10 Lincoln lambs, first experiment	928	930	138	217	1,840	.....	.....	901	499.5	.55	3,639.60	7.29	14.47	2.89
Summary for the breed, both experiments	1,819.20	1,791.05	354.13	341.51	4,126.10	.....	.....	1,160	943.5	.50	7,681.89	8.03	27.18	2.88
9 Leicester lambs—Sept. 16 to 30	69.40	71.17	34.70	.....	305.10	269.10	243	.....	64	.47	511.46	7	1.45	2.26
9 Leicester lambs—October	240.24	240.24	60.06	34.81	695.70	650.70	.....	.....	163	.58	1,190	7.30	3.88	2.31
9 Leicester lambs—November	259.20	259.20	64.80	45.36	554.70	316.40	.....	61.20	93	.34	1,070.34	11.50	3.52	3.78
9 Leicester lambs—December	273	303.95	52.27	41.48	664	.....	.....	274	105	.37	1,198.99	11.41	3.63	3.45
Leicester totals and averages	841.84	874.56	211.83	121.65	2,219.50	1,236.20	243	335.20	425	.44	3,970.79	9.34	12.48	2.93
9 Leicester lambs, first experiment	793	793	122	193	1,619	.....	.....	911	424	.52	3,176.40	7.49	12.55	2.93
Summary for the breed, both experiments	1,634.84	1,667.56	333.83	314.65	3,838.50	.....	.....	1,246.20	849	.47	7,147.23	8.42	25.03	2.93
9 Cotswold lambs—Sept. 16 to 30	69.46	71.21	34.72	.....	247.90	269.10	243	.....	85	.62	462.06	5.43	1.33	1.56
9 Cotswold lambs—October	259.32	259.32	64.72	32.45	698.90	652.50	.....	.....	177	.63	1,203.43	6.79	4.00	2.21
9 Cotswold lambs—November	261.20	261.20	65.30	45.71	659	316	.....	88.45	96	.35	1,167.59	12.16	3.75	3.90
9 Cotswold lambs—December	273	304.95	52.27	41.38	654	.....	.....	273	121	.43	1,229.99	10.74	3.62	2.99
Cotswold totals and averages	862.98	896.68	217.01	119.54	2,259.80	1,237.60	243	361.45	479	.50	4,063.07	8.48	12.70	2.65

10 Cotswold lambs, first experiment	928	930	138	217	1,844	.....	.....	901	556.5	.62	3,633.50	6.53	14.49	2.60
Summary for the breed, both experiments	1,790.98	1,826.68	355.01	336.54	4,103.80	.....	.....	1,262.45	1,035.5	.55	7,695.57	7.45	27.19	2.62
9 Dorset lambs — Sept. 16 to 30	69.75	71.47	34.87	.....	313.50	210.50	239.40	.....	70	.52	513.86	7.34	1.41	2.00
9 Dorset lambs — October	286.49	286.49	64.12	18.76	713	659	.....	.....	144	.51	1,253.77	8.70	4.05	2.81
9 Dorset lambs — November	250.72	250.72	62.68	43.87	659	223	.....	88.50	90	.22	1,110.07	12.33	3.66	4.05
9 Dorset lambs — December	257.56	287.36	49.40	39.11	667	.....	.....	263	110	.39	1,217.70	11.07	3.49	3.17
Dorset totals and averages	864.52	896.04	211.07	101.74	2,352.50	1,092.50	239.40	351.50	414	.43	4,095.40	9.89	12.61	3.04
10 Dorset lambs, first experiment	859	861	127	200	1,749	.....	.....	970	436	.48	3,422.80	7.85	13.31	3.05
Summary for the breed, both experiments	1,723.52	1,757.04	338.07	301.74	4,101.50	.....	.....	1,321.50	850	.45	7,518.02	8.84	25.92	3.05
8 Rambouillet lambs — Sept. 16 to 30	57.21	58.57	28.60	.....	246.08	161.79	186.67	.....	57	.47	408.19	7.16	1.12	1.96
8 Rambouillet lambs — October	212.40	212.40	23.10	38.01	538.33	522.89	.....	.....	122	.49	939.32	7.69	2.94	2.41
8 Rambouillet lambs — November	203.48	203.48	50.87	35.61	538	256	.....	79	74	.30	932.51	12.60	2.63	3.55
8 Rambouillet lambs — December	203	227.05	38.73	30.72	534	.....	.....	229.50	59	.23	929.57	15.75	2.59	4.39
Rambouillet totals and averages	676.09	701.50	141.30	104.34	1,856.41	940.68	186.67	308.50	312	.37	3,209.59	10.29	9.28	2.91
10 Delaine Merino lambs, first experiment	680	678	101	157	1,041	.....	.....	743	258	.29	2,412.50	9.35	9.76	3.78
Summary for the Merinos, both experiments	1,356.09	1,379.50	242.30	261.34	2,897.41	.....	.....	1,051.50	570	.32	5,622.09	9.86	19.04	3.34
Grand total, all breeds, second experiment	7,491.21	7,529.85	1,819.79	1,053.09	19,496.71	10,173.48	2,020.07	2,895.35	3,568	.415	34,632.70	9.67	108.45	3.04
Grand total, first seven breeds, second experiment	5,950.60	5,932.31	1,467.42	847.01	15,287.80	8,140.30	1,594	2,314.35	2,842	.418	27,227.71	9.58	86.56	3.04
Grand total, first seven breeds, first experiment	6,089	6,097	907	1,429	12,990	.....	.....	5,929	3,281	.53	23,791.90	7.25	94.69	2.88
Grand total, first seven breeds, both experiments	12,039.60	12,029.31	2,374.42	2,276.01	28,277.80	.....	.....	8,243.35	6,123	.467	51,019.61	8.33	181.25	2.96
Grand total, all breeds, both experiments	16,404.21	16,449.85	1,951.79	3,138.09	36,629.71	.....	.....	11,887.35	8,246	.448	69,134.20	8.38	245.69	2.97
10 Shropshire ewes, second experiment — Sept. 16 to 30	59.38	60.91	29.69	.....	257	223	194	.....	72	.48	429.52	5.96	1.21	1.69
10 Shropshire ewes, second experiment — October	216.09	216.09	54.02	31.15	588	583	.....	.....	102	.32	1,014.50	9.94	3.42	3.34
10 Shropshire ewes, second experiment — November	212	212	53	37.10	539	293.50	.....	81.50	77	.25	956.15	12.41	3.09	4.03
10 Shropshire ewes, second experiment — December	206.28	232.28	39.77	31.49	557	.....	.....	254	82	.26	1,031.07	12.57	2.89	3.52
Shropshire ewes, totals and averages	693.75	721.28	176.48	99.74	1,941	1,099.50	194	335.50	333	.31	3,431.24	10.30	10.61	3.18

The record of the second experiment, as will be seen by reference to the summary, is hardly as uniform or as good as that of the first; the difference was attributed mainly to the interference caused by the stomach worms which seriously infested nearly all of the lambs at the beginning and to some extent throughout the experiment. They were unusually severe throughout nearly all of the sheep-raising States that year, more so than they have been at any time since, though they are annually the source of considerable loss to sheep raisers in the farming sections.

In the first experiment the increase in live weight was made at the cost of 2.93 cents per pound for all breeds, and 2.88 cents per pound for the seven special mutton breeds. This calculation allows the prevailing market price for grains, but does not take the fleece, the labor, or the value of the manure into account. In the second experiment the cost was increased for all breeds to 3.04 cents, owing to the difficulties previously mentioned; but notwithstanding this the increase in live weight was made at considerably less than the market price of mutton in both cases, as will be seen by the following record of sales:

Weights and selling price per hundredweight of the lambs.

Breed.	First experiment		Second experiment.	
	Weight.	Price.	Weight.	Price.
	Pounds.		*Pounds.*	
Southdown	125	$4.75	102.4	$5.75
Shropshire	135	4.62½	126	5.60
Oxford	155	4.50	136.7	5.40
Suffolk	159	4.25	134.4	5.00
Lincoln	158	4.50	143.5	5.25
Leicester	167	4.50	133	5.25
Cotswold	161	4.50	138.4	5.25
Dorset	138	3.75	128.3	5.50
Merino	99	4.25	113.3	5.00
Shropshire-Merino crossbred	111	4.50	.....	.....
Shropshire ewes	.....	.....	100	5.65

The price of grain feeds during this experiment was somewhat lower than is common in many of the grain-producing States, although the cost of producing mutton at average prices of grain will seldom be found above the market value, even when the value of the fleece is not taken into account. In the first experiment the lambs were shorn before they were marketed, and the following table presents a record of the average weights and values of the fleeces from each breed:

Weights and value of the fleeces.

Breed.	Date of shearing.	Average age of fleece.	Average weight of fleece.	Value per pound in natural condition.	Per cent shrinkage in scouring.	Value per pound in scoured condition.	Value of fleece per head.
		Days.		*Cents.*		*Cents.*	
10 Southdown lambs	Mar. 23	366	6.75	11½	54½	26	*a* $0.75
10 Shropshire lambs	Mar. 23	363	8.75	11	56½	25	.98
10 Oxford lambs	Mar. 21-23	365	10.95	12¾	47	24	1.44
10 Suffolk lambs	Mar. 21	383	7.65	11	54½	24	.86
10 Lincoln lambs	Mar. 17-20	332	12.85	13¾	40	23	1.79
9 Leicester lambs	Mar. 18-20	348	11.55	14¾	38½	24	1.76
10 Cotswold lambs	Mar. 17-20	334	12.65	13	43½	23	1.66
10 Dorset lambs	Mar. 18-20	355	6.825	10¾	55½	24	.77
10 Merino lambs	Mar. 18-20	359	9.9	9¾	67½	30	1.00
10 crossbred lambs	Mar. 18-20	334	7.5	11¾	53	25	.90
10 range lambs	Mar. 20-21	321	5.125	12½	48	24	.67
10 Shropshire yearlings	Mar. 21	313	10.5	12¼	49	24	1.34

a The values in this column are obtained by dividing the value of wool from each breed by the number of sheep. The Chicago weights varied a little from the home weights taken at date of shearing.

The lambs were considerably younger in the second experiment and the fleeces were correspondingly lighter, as will be seen by reference to the summary following the illustrations. The estimated value of the wool on the lambs in the second experiment was reported by a firm who are leading wool commission merchants of Chicago, as follows:

DEAR SIR: At your request we carefully inspected the ten different lots of your sheep at the Union Stock Yards, this city, with a view of ascertaining as nearly as possible to-day's market value of the wool. While it is a little out of our line to examine wool on the sheep's back, we exercised our very best judgment and give you below the result of our careful inspection.

We place the value on to-day's market of the Southdown wool, which we class in a general way as medium, at 14 cents.

The Lincoln wool would be classed as common combing, and worth 15 cents.

The Leicester wool we also classed as common combing, value 15 cents.

The Shropshire, low medium, value 14 cents.

The Oxford, low medium and quarter-blood, value 14½ cents.

The Suffolk, medium, value 14½ cents.

The Shropshire ewe lambs, value 14½ cents.

The Dorset, medium, value 14 cents.

The Cotswold, combing, value 15 cents.

The French merino, value 11 cents.

Without doubt, if the wool had been shorn and all passed over the grading board in our lofts, some individual fleeces from the different lots would be worth more or less than the prices given above. We however tried to make the average as near right as possible.

Trusting the same will meet with your approval, and hoping that the experiments which have been conducted by you will prove to be a benefit to the sheep growers of the West, we beg to remain,

Yours, truly, ——— ———.

This lot of lambs was not shorn before marketing, but was examined at the yards by experts, and the weight of fleece obtained by deducting from the weight of the pelts the estimated weight of the skins based on the slaughter test of the same breeds in the previous experiment. This doubtless was approximately accurate.

RELATIVE COST OF PRODUCING MUTTON AND BEEF.

The gains made in each experiment were, all things considered, quite satisfactory, and compare favorably with results in beef production. A carload of choice Hereford cattle coming 2 years old was fattened during the same winter that the first lamb experiment was conducted. These were finished and put on the market at the same time as the lambs. The record made by these cattle was fairly representative of the best work in cattle feeding at that age, and it was found that they required an average of 8.9 pounds of dry matter for each pound of increase in live weight.

A summary of results published by the Ohio Experiment Station,[1] compiled from experiments conducted with a large number of cattle at various stations in the United States, gives the average number of pounds dry matter per pound of increase in live weight at 10.24, and a recently published report of the work of Lawes and Gilbert[2] gives 11 pounds for cattle and 9 pounds for sheep. The better results obtained at the Iowa station in this experiment are doubtless largely due to the fact that younger animals were used. The conditions for comparison appear fair, however, as both the cattle and sheep were finished at a comparatively early age. This indicates that a pound of mutton can be made on lambs at less expenditure for feed than is required to produce a pound of beef on cattle at the ordinary age of finishing for market.

FEED CONSUMED PER 1,000 POUNDS LIVE WEIGHT.

It is sometimes asserted that cattle and sheep require the same amount of feed per thousand pounds of live weight. This statement seems not to be well founded. In the experiments referred to the cattle consumed 19.6 pounds of dry matter per thousand pounds of live weight, against an average of 29.07 by the sheep. Both sheep and cattle were on full feed. The sheep made a daily gain of 3.73 pounds per thousand pounds live weight, and the cattle 2.14. In summing up this comparison, we find that while the sheep ate 48 per cent more than the cattle, they also gained nearly 75 per cent more.

ADVANTAGE OF FINISHING AT AN EARLY AGE.

With older sheep a larger amount of feed is required in proportion to increase in live weight. This was quite clearly demonstrated in the experiment conducted by the Iowa Stations[3] in which the costs of producing gain on pure-bred Shropshire wethers and lambs under the same conditions and on the same ration were compared:

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[1] Bulletin No. 60, Ohio Station, by Thorne and Hickman.

[2] Farmers' Gazette, Dublin, Ireland.

[3] Bulletin No. 33, Iowa Station.

Feeding of lambs and yearlings compared.

Breed.	Month.	Mixed grain.	Roots.	Hay.	Total gain.	Average gain per head daily.	Total dry matter.	Pounds of dry matter per pound of gain (average).	Total cost of feed.	Cost of feed per pound of gain (average).
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*			*Cents.*
10 Shropshire lambs	Jan...	595	279	464	123	.39	957.7	7.78	$3.78	3.7
	Feb...	648	269	495	136	.46	1,030.4	7.57	4.14	3.4
	Mar ..	681	234	564	170.5	.56	1,093.6	6.43	4.45	2.61
Totals and averages..	.....	1,924	782	1,523	429.5	.48	3,081.7	7.18	12.37	2.88
5 Shropshire yearlings	Jan...	403	186	250	59	.34	594.3	10.07	2.38	4
	Feb...	362	174	216	38	.26	527.4	13.88	2.16	5.7
	Mar ..	340	136	233	52.5	.35	516.6	9.93	2.10	4
Totals and averages..	.....	1,105	496	699	149.5	.33	1,638.3	11	6.64	4.44

It will be seen that it cost 56 per cent more to produce gain on yearlings than on lambs of the same breed; perhaps this difference is somewhat greater than would ordinarily occur on account of the wethers being somewhat fatter at the beginning of the experiment than the lambs, although the comparison from month to month shows a wide difference in each case. It always costs proportionately less to make gains on young animals than on older ones.

LAMBS PREFERRED IN THE MARKETS.

The market also favors the younger animal. In this case the yearlings sold for $4.25 per hundred, live weight, and the lambs for $4.75 on the same market, a difference of 10 per cent in favor of the lambs. On this account it is generally more profitable to finish sheep for market under 1 year of age than to hold them longer unless an abundance of cheap feed is available, as is the case where lands are cheap or free range accessible.

In the slaughter test the lambs dressed the following percentages of net carcass to live weight:

Percentages of yield of dressed mutton.

Breed.	First experiment.	Second experiment.
Southdown	55.4	55.26
Shropshire	56.3	52.88
Oxford	55.2	50.08
Suffolk	53.6	52.54
Lincoln	55.7	51.08
Leicester	57.8	51.87
Cotswold	54.9	53.57
Dorset	52.6	54.11
Merino	51.8	49.57
Crossbred	53.7	.....

The Shropshire yearlings fed in comparison with the Shropshire lambs dressed 62.3 per cent.

The details of the slaughter test of the lambs in the first experiment made by Swift & Co., of Chicago, are shown in the following tables, giving the weight and percentage of each part:

*Slaughter test.**

Part.	10 Southdown lambs.		10 Shropshire lambs.		10 Oxford lambs.		10 Suffolk lambs.		10 Lincoln lambs.		9 Leicester lambs.	
	Weight.	*Per cent.*	*Weight.*	*Per cent.*	*Weight.*	*Per cent.*	*Weight.*	*Per cent.*	*Weight.*	*Per cent.*	*Weight.*	*Per cent.*
Mutton	651	59.24	696	58.78	800	60.24	800	58.36	808	59.50	815	62.88
Pelts	100	9.09	104.5	8.83	131	9.86	121	8.82	148.5	10.94	118	9.11
Blood	42.5	3.88	48	4.05	54.5	4.11	58	4.23	57.5	4.23	53.5	4.12
Heads	29.5	2.68	29.5	2.49	38	2.86	39	2.84	35.5	2.61	32.5	2.51
Horns												
Tongues	4.5	.42	4	.34	5.5	.41	5.5	.41	5	.37	4.5	.35
Feet	6	.54	6.5	.55	8.5	.64	8	.59	8	.58	7.5	.59
Caul fat	38.25	3.48	44.5	3.76	40	3.01	46.5	3.39	43	3.09	41	3.16
Bed tallow	3.5	.32	2.5	.22	4	.30	4	.29	3.5	.25	3.5	.27
Paunches, empty	32.5	2.95	35.5	2.99	41.5	3.13	44	3.21	39.5	2.91	38	2.93
Paunches, waste	65.5	5.98	82.5	6.97	63	4.76	99.5	7.26	73	5.39	55	4.25
Paunches, fat	3.5	.32	3.5	.30	3.5	.26	4	.28	4	.29	3.5	.28
Intestines, empty	18.5	1.68	18.5	1.56	21	1.58	22	1.61	21	1.54	18	1.39
Intestines, waste	40.5	3.64	41.5	3.51	47.5	3.58	49.5	3.61	45.5	3.35	44.5	3.43
Intestines, fat	14.5	1.32	15.5	1.31	15	1.13	19	1.39	14.5	1.07	14.5	1.11
Livers	20.5	1.86	23.5	1.98	21	1.58	18	1.31	21	1.54	21.5	1.66
Hearts	4.5	.42	5	.42	5.5	.41	5.5	.41	5.5	.42	6	.47
Lungs and windpipes	19	1.73	16.5	1.39	22.5	1.69	21	1.53	19	1.50	14.5	1.11
Heart fat	1.5	.13	2	.17	1.5	.11	2	.14	2	.14	1.5	.11
Pluck fat	3.5	.32	4.5	.38	4.5	.34	4.5	.32	4	.28	3.5	.27
Total	1,099	100	1,184	100	1,328	100	1,371	100	1,358	100	1,296	100

*The percentages of dressed mutton given in this table do not correspond with those given on the preceding page, but Swift & Co. explain that the variation is due to the fact that the slaughter-test percentages are computed from the warm weights, while the others are from cold weights.

Slaughter test—Continued.

Part.	10 Cotswold lambs.		10 Dorset lambs.		10 Merino lambs.		10 Crossbred lambs.		10 Range lambs.		5 Shropshire yearlings.	
	Weight.	*Per cent.*	*Weight.*	*Per cent.*	*Weight.*	*Per cent.*	*Weight.*	*Per cent.*	*Weight.*	*Per cent.*	*Weight.*	*Per cent.*
Mutton	795	58.89	666	57.27	496	56.11	554	57.35	516	56.16	560	66.10
Pelts	141	10.44	93	8	92	10.41	108.5	11.23	102	11.09	70	8.26
Blood	55.5	4.11	49	4.21	40	4.53	42	4.35	39.5	4.29	32	3.76
Heads	37	2.74	37.75	3.25	33.5	3.79	26.5	2.74	25.5	2.77	19	2.24
Horns			25	2.15	7	.79						
Tongues	5	.37	4.75	.41	4.5	.51	4	.41	3.5	.38	2.5	.29
Feet	8.5	.63	7.5	.65	5.5	.62	6	.62	6	.66	3	.35
Caul fat	41	3.04	25.5	2.19	38	4.30	42.5	4.40	39	4.24	36	4.25
Bed tallow	3	.22	3	.26	2.5	.28	2.5	.26	2.5	.27	2	.23
Paunches, empty	43.5	3.22	39	3.35	26.5	3	27	2.80	23	2.50	19.5	2.30
Paunches, waste	85.5	6.33	78	6.71	36.5	4.13	43	4.45	55.5	6.09	31	3.66
Paunches, fat	3.5	.26	2.5	.21	3	.34	3	.31	3.5	.38	3	.35
Intestines, empty	21	1.56	21	1.80	15	1.70	25.5	2.64	15.5	1.68	11.5	1.36
Intestines, waste	47.5	3.52	46.5	4	30.5	3.45	25.5	2.64	39.5	4.29	16	2.08
Intestines, fat	13	.97	13.5	1.16	16	1.81	15.5	1.60	11.5	1.25	12	1.41
Livers	22	1.63	18.5	1.59	15.5	1.75	17	1.76	14	1.52	13.5	1.53
Hearts	5.5	.41	5	.43	4	.45	4.5	.47	4	.42	4	.47
Lungs and windpipes	16.5	1.22	17.5	1.50	14	1.58	12.5	1.29	14	1.52	7	.82
Heart fat	1.5	.11	1.5	.13	2.25	.25	1.5	.16	1.5	.16	2.5	.27
Pluck fat	4	.29	8.5	.73	1.75	.20	5.5	.57	3	.33	2.5	.27
Total	1,350	100	1,163	100	884	100	966	100	919	100	847	100

METHOD OF CUTTING MUTTON.

The method of cutting a carcass is shown in the accompanying diagram, and the prices given for the several cuts are based upon the Chicago market for prime mutton at the time of this experiment.

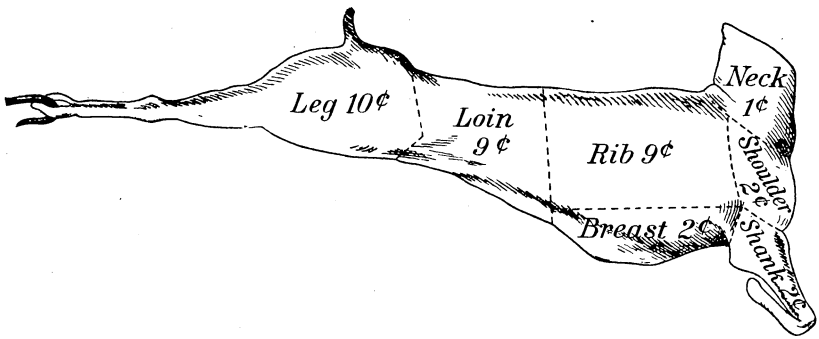

FIG. 13.—Diagram showing cuts of mutton.

The weights and values given below for the several cuts are the averages made by the seven special mutton breeds in the first experiment.

Leg, 22.2 pounds, at 10 cents	$2.22
Loin, 17.5 pounds, at 9 cents	1.57
Rib, 14.5 pounds, at 9 cents	1.30
Chuck,[1] 19.8 pounds, at 1¾ cents	.34
	5.43

It will be seen that the leg, loin, and rib are the high-priced cuts that determine the value of a carcass of mutton. An animal that fails in one of these, fails essentially to meet the requirements of the market for high-priced mutton. This is particularly true of the leg cut; and plump, well-filled legs are indispensable in prime lambs.

The following illustrations present good front and back views of a carcass selected as a model at the Union Stock Yards, Chicago. It shows a remarkably well-filled leg, back, rib, and loin; the flesh being even and thick at all points, and on cutting it was found to be of superior quality throughout. This is the profitable type of carcass to the killer and consumer as it contains the highest proportion of choice meat and the minimum of cheap product and offal. It was taken from a 95-pound Southdown.

[1] The chuck consists of the breast, shank, shoulder, and neck.

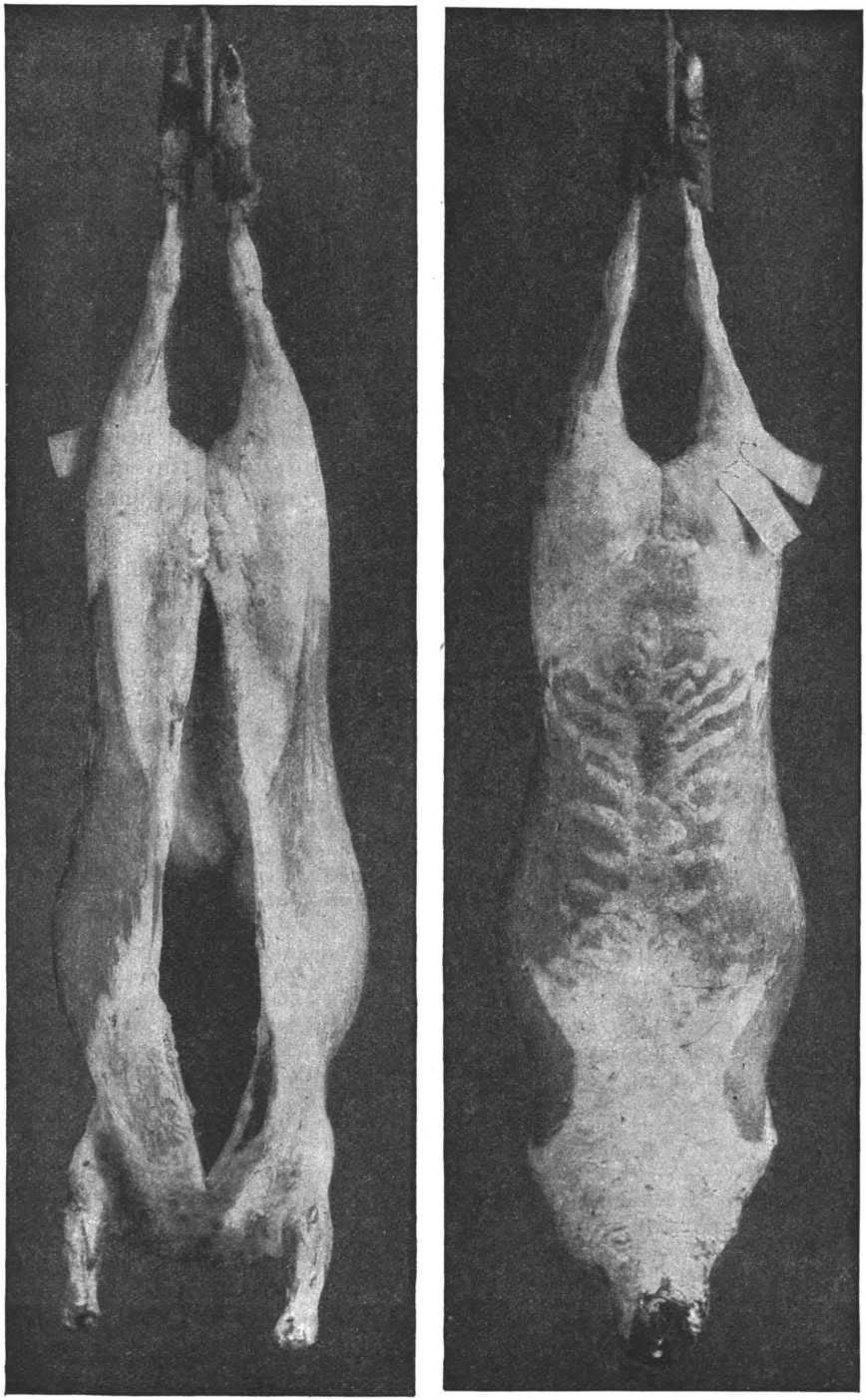

FIG. 14—(*a*) Southdown carcass—front view; (*b*) Southdown carcass—back view.

RANGE LAMB FEEDING.

The territory west of the one hundredth meridian, known as the Range, is rapidly becoming the great breeding ground for sheep. Already this locality is producing about one-half of the total number of sheep in the United States During the past few years sheep have been rapidly crowding the cattle off of the northern portion of this Range territory, and it is quite generally recognized that the range-cattle industry is gradually disappearing, except in the southern section. While this territory is favorable to the grazing of stock in large numbers, the natural conditions will not permit of the production of sufficient feed to properly fatten and finish the stock grown there. The finishing can only be done by drawing on the surplus grain crops of the upper Mississippi Valley States. This has been largely practiced during the past few years, owing to the shortage of good feeding stock in the farming sections, the surplus of grain products, and prevailing low prices. On this account there is a general interest in the character and feeding value of the sheep raised on the Range. These sheep are classified by Prof. W. W. Cooke as follows:[1]

Old Mexico Sheep.—These sheep are the direct descendants of the original Spanish-Merinos, brought over two hundred years ago by the Spaniards to Old Mexico. They have been bred with scarcely any outcross and are very distinctly marked. They have long legs; a long thin body, not very deep; small, rather long neck, and a long thin head, carried high. The wool is fine and thin. To the eye they appear almost worthless as mutton sheep, and of still less value for wool. Their good points are that they are hardy, excellent travelers, will keep in good condition on the poorest and driest of ranges, are fairly prolific, and can be herded in bunches of almost any size. They fatten easily, though never looking plump and fat, like the Northern sheep. When they reach the Chicago market, if in good condition, they outsell all other sheep, for they shrink very little in dressing, the meat has an excellent flavor, and the hide is so thin, firm, and soft as to command the highest price. A well-fattened bunch of Mexican lambs will weigh, on the Chicago market, from 78 to 81 pounds. Yearlings, ewes, and old wethers of this breed are in good condition if they weigh 90 pounds in Chicago.

New Mexico sheep.—These original Mexican sheep have been largely graded with Merino rams in New Mexico and southern Colorado, and for some years were run there as grade Merinos for wool. They have not the thick wrinkly fleece of the typical Merino and show decidedly their Mexican origin, being intermediate, in length of leg, body, neck, and head, between the true Merino and the Mexican. They are a small-bodied, quick-maturing sheep, and, although never growing very large, they get very fat. It takes them longer to fatten than the better bred sheep. Never less than five and usually six months elapse from the time they are put on feed until they go to market.

The bunches of lambs brought from New Mexico run quite even in size and appearance. They are all kept under the same condition, and but few of the flocks have as yet been topped with mutton breeds so as to present any great variation from the general type. When brought to Colorado in the fall, about the 1st of November, the lambs weigh, in bunches, from 48 to 53 pounds. When shipped to Chicago, in May, they weigh from 80 to 84 pounds. Their frames are then not much larger than in the fall, but the body is much deeper, almost touching the ground, and they are almost as thick through, making them very plump. They easily get the highest prices on the Chicago market, for the same reasons as the Mexican sheep.

[1] Bulletin 32, Colorado Experiment Station.

Merinos.—Until a few years ago, nearly all the sheep of Colorado, Wyoming, Utah, and Idaho were straight Merino sheep, bred for the most part from Merinos brought from the East. Some flocks originated from the Mexican or New Mexican sheep, but they were crossed so many times with thoroughbred Merino rams as to lose the characteristics of the southern sheep. So long as these flocks were used for wool they were carefully bred by purchasing high-priced rams from the East. As the price of wool fell, the profits decreased until some seven or eight years ago a point was reached where the sheep for mere wool ceased to be profitable. Many flocks were sold, and those sheep men that continued in the business turned their attention to wool and mutton. Many of them still continue to use Merino rams, but the number of these flocks is constantly decreasing, and, especially from western Wyoming westward, the use of rams of the mutton breeds has become almost universal. These Merino flocks from the north retain the thick fleece of the original Merino, since the climate is not hot enough to thin out the fleece as it does in New Mexico and Texas. Most of the wrinkles disappear, but a few remain around the shoulders, and the face has the Merino color distinct, being thus easily told from the southern sheep, which have no wrinkles and very thin wool around the head. The lambs are short legged and consequently not such good travelers as the southern sheep, nor do they need to be, for the Wyoming ranges will average much better than the New Mexican. The lambs appear larger than the New Mexican, but will not weigh quite so much. From 42 to 47 pounds is an average weight on the 1st of December. They grow a little more rapidly when put on feed than southern sheep, and will stand a little heavier feeding. In May they will weigh in Chicago just about the same as the southern lambs, yet, if equal bunches were put on the market together, the southern would more rapidly find a purchaser. The ewes, yearling wethers, and older wethers of the Merino are heavier than those of the southern sheep. Yearling wethers the first of December should weigh from 80 to 90 pounds; old wethers occasionally go over 100 pounds. They fatten more quickly than the lambs—much more quickly than the southern lambs. Four months' feeding is always sufficient, and many bunches will be ready for market after three months. They should weigh in Chicago from 115 to 125 pounds.

In order to compare the feeding value of this class of sheep with the native-bred mutton sheep, a carload of 252 head was obtained by the Iowa Experiment Station in the fall of 1896. They were especially selected for the experiment near Las Cruces, N. Mex., by a prominent firm of Chicago commission merchants. The shipment comprised 4 lots, designated as follows: Lot I, 63 head shorn Merino lambs; Lot II, 63 head coarse-wool New Mexicans; Lot III, 63 head Down-blood cross on Merino stock; Lot IV, 63 head of unshorn Merinos. The illustrations on the following pages furnish a good idea of the characteristics and appearances of representative lambs from each lot. They arrived at the station grounds November 3, were dipped the next day, and turned onto blue-grass pasture with a very light feed of bran and oats morning and evening; they also had access at night to good hay of which they ate freely. On December 1 they were divided as previously classified, and went into the experiment at the following weights:

Lot I, 63 head shorn Merinos, 2,950 pounds.
Lot II, 63 head coarse-wool New Mexicans, 3,330 pounds.
Lot III, 63 head Down cross, 3,390 pounds.
Lot IV, 63 head unshorn Merinos, 3,340 pounds.

During the preliminary period from November 3 to December 1 the lambs made an average gain of only about one pound per head, but the change of conditions and the dipping are, perhaps, accountable for this low result.

FIG. 15.—Representative lambs from Lot I, shorn Mexican Merinos.

The 252 head of lambs were fed through the entire experiment and sent to market with the following record of weights and gains for each lot during the 110 days they were on feed:

Breed.	Weight Dec. 1.	Average.	Weight Mar. 1.	Average.	Average gain.
Lot I, 63 shorn Merinos	2,950	46.9	4,796	76.1	29.2
Lot II, 63 coarse wool	3,330	52.8	5,114	81.1	28.3
Lot III, 63 Down cross	3,390	53.8	5,212	82.7	28.9
Lot IV, 63 unshorn Merinos	3,340	53	5,080	80.6	27.6
Total	13,010	51.6	20,202	80.1	28.5

The following is a complete record of the amount and cost of feed consumed during the experiment, and this table also includes other

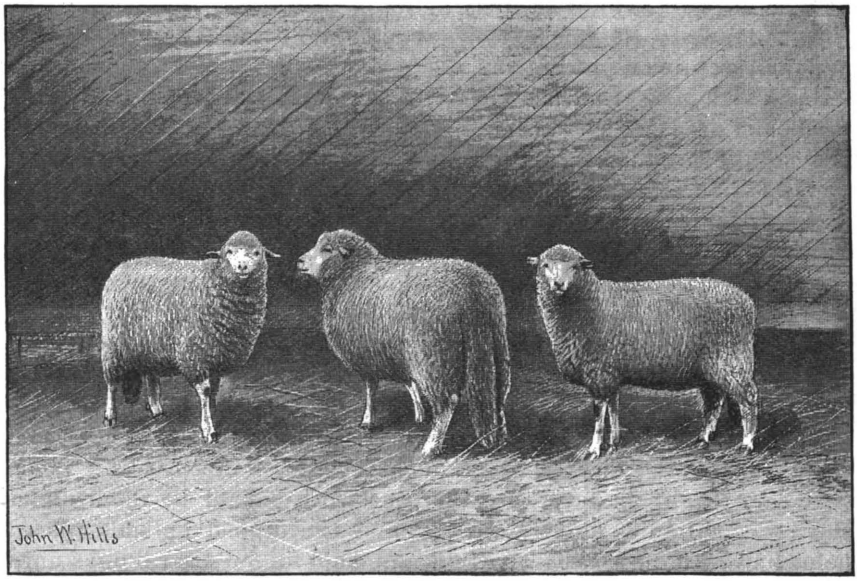

FIG. 16.—Representative lambs from Lot II, Coarse-Wool Mexicans.

calculations that furnish a basis for comparison with pure-bred lambs, fed at the Iowa Station and elsewhere during the same and the preceding winter:

Breed.	Oats.	Corn.	Bran.	Oil meal.	Mangels.	Hay.
Lot I (63) Shorn Merinos	2,785	3,135	514	324	743	14,360
Lot II (63) Coarse Wool	2,813	3,168	518	327	743	14,360
Lot III (63) Down Cross	2,813	3,168	513	327	743	14,360
Lot IV (63) Unshorn Merinos	2,728	3,069	533	317	743	14,360
Summary	11,039	12,540	2,078	1,295	2,972	57,440

Breed.	Total gains.	Average gain per head daily.	Total dry matter.	Pounds of dry matter per pound of gain.	Total cost of feed.	Cost of feed per pound of gain.
						Cents.
Lot I (63) Shorn Merinos	1,846	.266	18,253	9.88	$49.83	2.7
Lot II (63) Coarse Wool	1,784	.257	18,314	10.26	50.04	2.8
Lot III (63) Down Cross	1,822	.263	18,314	10.05	50.04	2.74
Lot IV (63) Unshorn Merinos	1,740	.251	18,153	10.43	49.50	2.84
Summary	7,192	.259	73,034	10.15	199.41	2.77

DIPPING.

Nearly all range sheep are affected with scab, though it is frequently held in check so as to be scarcely noticeable when the sheep first arrive from the range. Its development appears a few weeks later, however, and unless proper precautions are taken it becomes a serious interference with good results in fattening, besides a source of infecting the yards and premises with the germs of this disease. On this account it is generally considered best to dip all range sheep brought to the farming sections for feeding. The dipping should be done immediately or at least very soon after arrival, and repeated in about ten days to insure effective work. In case this has not been done promptly on arrival of the sheep and the disease makes its appearance during the winter, it is generally advisable to attend to the dipping without further delay, even though the weather may be quite severe, as postponement will only prolong the difficulty and at the same time cause greatly diminished gains as well as much lower value on the market. Sheep may be dipped even at a zero temperature with less menace to the flock than to allow the disease to go unchecked for a few weeks. When necessary to dip in severe weather, the work should be done under shelter in a liquid slightly warmed and the dipped animals placed immediately in dry, warm quarters and kept in for several days until the fleeces have had time to dry.

There are various dips on the market and in common use. Lime and sulphur and the tobacco dips are effective and popular where the work is done on a large scale. A number of the prepared dips on the market are equally effective, and they have the additional advantage of promoting a more favorable condition of the fleece. All farm flocks should also be dipped at least once a year for the general good effects resulting from dipping regardless of the existence of scab. (For a full discussion of dips, dipping vats, etc., see Bulletin No. 21 of the Bureau of Animal Industry, U. S. Department of Agriculture, entitled Sheep Scab.)[1]

THE FEEDING OF RANGE AND PURE-BRED LAMBS COMPARED.

The range lambs averaged only about half as much gain per head daily as the pure-bred mutton lambs. This marked difference is mainly due to the fact that the Western sheep, reared under semiarid conditions and scanty vegetation, have only about one-half as much digestive capacity as our larger breeds, accustomed to more liberal feeding. In this experiment the range lambs consumed more feed (dry matter) for a pound of gain than those of the mutton breeds. The rations were somewhat different, however, and this variation probably accounts for the larger amount of feed consumed for a given gain, as their ration consisted more largely of hay and contained a larger percentage of indi-

[1] Bulletin No. 38, Colorado Experiment Station, also contains much valuable information on the same subject.

gestible matter. In the first of the pure-bred lamb experiments previously described a lot of 10 northern range-bred lambs from Wyoming was fed in comparison with the mutton breeds, and it was found that, while they consumed considerably less feed than the pure-breds and gained only an average of 0.37 of a pound per head daily while the mutton breeds gained an average of 0.53, this gain was made at the rate of 1 pound for each 6.84 pounds of feed consumed, while the average for the others was 1 pound for each 7.25 pounds of feed consumed; consequently they produced this gain even a little more economically than the lambs of the improved mutton breeds. This result may seem

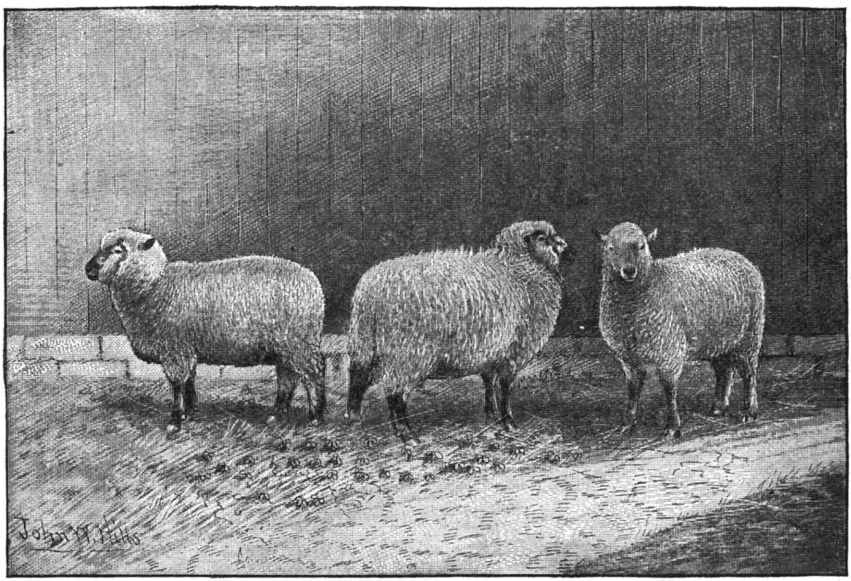

FIG. 17.—Representative lambs from Lot III, Down cross on Merino foundation.

somewhat contrary to the generally accepted doctrine concerning the value of improved blood. A principle of feeding which has been quite clearly established is that animals of pure breeding, whether sheep, cattle, or hogs, are not capable of rendering much, if any, higher returns for a given amount of feed than the so-called "scrub," or native unimproved stock. This matter seems to be governed by the powers of digestion which are not materially modified by artificial conditions. The chief value of improved blood lies in the capability of higher excellence of finished product and a correspondingly higher selling value. Similar results have also been obtained at other experiment stations where feeding tests have been carefully conducted. In an experiment

conducted at the Minnesota Experiment Station by Prof. Thomas Shaw, similar conclusions were reached.

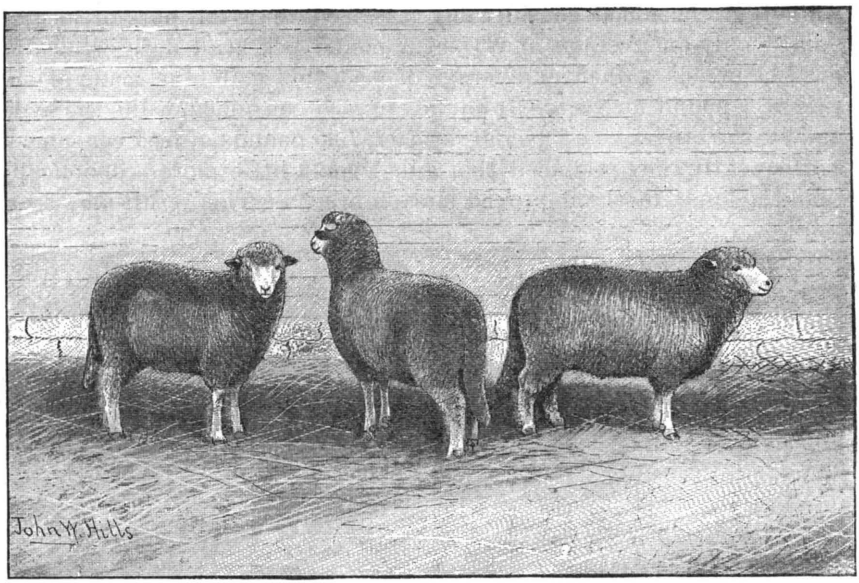

FIG 18.—Representative lambs from Lot IV, unshorn Mexican Merinos.

THE VALUE OF IMPROVED BLOOD.

It has sometimes been asserted that some of the native unimproved lambs are superior for feeding purposes and mutton production to the improved mutton breeds. This conclusion probably had its origin in the fact that the Mexican and other types of range-bred lambs have at times been quoted as high, and in some instances a little higher, than any other lambs on the market. This is due to other reasons, however, and does not justify the conclusion that no advantage results from improved breeding. The relatively high price at which range lambs sometimes sell is largely due to the fact that they are of the desired light weight, and, owing to the long distance in shipping, they are well shrunken when they reach the market and kill out a better percentage of net meat than would otherwise be the case. Notwithstanding these points in their favor, however, the best mutton lambs marketed by the Iowa Experiment Station have always outsold the best range lambs on the market by from 15 to 25 cents per hundredweight. The home-bred lambs made a larger net profit per lamb in the comparison at the Minnesota Station, even though they were rather an inferior lot, but they did not gain as rapidly or as economically as the range lambs.

In the range-lamb feeding experiment conducted at the Iowa Station, one lot had a cross of improved blood (evidently from one of the Down breeds) and the others had not. These lambs, raised under the same conditions on the range, and finished under the same conditions in the feed yard, sold for a higher price and returned a higher net profit than the other lots, though they made no larger gains. The profit made on the several lots is shown below:

Breed.	Selling price.	Net profit per head.
Lot I, Shorn Merinos	$4.75	$0.42
Lot II, Coarse Wool	5.15	.75
Lot III, Down Cross	5.25	.87
Lot IV, Unshorn Merinos	5.00	.70

At the Wisconsin Experiment Station[1] Prof. John A. Craig obtained a profit of $1.13 per head from well-bred lambs, against 65 cents from unimproved northern Wisconsin lambs fed under similar conditions.

WHAT CONSTITUTES A GOOD SHEEP.

The value of good blood has been emphasized in preceding pages. Not all the animals belonging to any of the improved breeds, however, are possessed of a high degree of excellence. No graver error can be made than the assumption of uniform excellence in the stock constituting any breed, no matter how much prominence it may have attained. Individual animals always differ more than breeds; and there are relatively few really good animals in any breed. This seems to be strikingly true of the mutton sheep. The chief trouble in mutton production is and always has been the scarcity of stock sheep, particularly sires, that have sufficient merit to fill the standard of excellence for a strictly prime carcass. Until we reach this higher degree of excellence the mutton sheep will not assume its rightful place in American agriculture. The American market has become the most discriminating in the world on beef products, and it will demand a corresponding superiority in mutton. With this in view a brief consideration of what constitutes a good mutton sheep may be of interest.

First, let there be pronounced masculinity in the male and femininity in the female. Sheep should be neither sexless nor characterless. They should bear the stamp and character of the breed they represent. This breed character is a mark of good blood, and it should be manifest in no unmistakable manner. The sire should be impressive, resolute, and of noble bearing. He should be distinctly the head of the flock in every sense of the word. To meet these requirements he must have good constitutional and vital powers. Without these no animal is fit to head a herd or flock. In selecting a sire, look first at the head. If

[1] Annual Report Wisconsin Experiment Station, 1896.

deficient there, look no further, but reject at once. Insist upon a head that faces you boldly with a wide face, a clear, prominent eye, and a robust character throughout. The head should be joined to a well-filled, round, muscular neck, wide at the poll and back of the ears and gradually enlarging in all lines to a strong, full junction at the shoulder, as seen from top, sides, or bottom. This should be accompanied by a wide chest, a prominent, well-filled brisket, and a full heart girth, giving straight, even lines from the shoulders back. A depression either in front of or behind the shoulder, whether at the top, side, or bottom line is an indication of weakness. The back should be strong, wide, and well meated from shoulder point to tail. The hind quarters should be full and well let down in the leg and flank, in order to yield well of high-priced meat. The legs should be placed wide apart and stand straight. Sickle-shaped hocks and weak, sloping pasterns afford sufficient reason for condemning an otherwise good sheep.

ESSENTIALS OF A GOOD FLEECE.

The modern mutton sheep must also be a wool producer. Our future wool supply must come largely from sheep grown primarily for mutton. It is essential, then, that a mutton sheep have a good fleece as well as a good carcass. This combination is both practicable and profitable; and it is no longer regarded necessary to grow one sheep for a fleece, another for a carcass, and another for a lamb. The intelligent flock-master combines them all in one class. Some of the best mutton sheep are producing as profitable fleeces as those kept exclusively for wool, and their lambs are decidedly superior. One of the first essentials in a good fleece is compactness or density. This quality not only insures a better yield of wool, but it affords better protection against storm and indicates a hardier animal, better able to withstand exposure. A close, even, dense fleece with no breaks should cover all parts of the body, including the head, limbs, and under parts. The tendency in improvement of the wool-producing qualities of all modern breeds has been toward carrying the fleece more completely over the head, face, limbs, and lower line. The advantage is not so much in the increased yield of wool grown on these parts, as that is of little consequence, but in the accompanying tendency to a larger and better yield of wool in all parts. A barefaced and barelegged sheep is always a relatively light shearer, and in contrast with this the sheep wooled from "the eyes to the toes" always yields a heavy fleece and the wool is generally of a better quality than from those having a scanty covering.

Fineness, length, and strength of fiber are essential qualities in a good fleece that should always have prominent consideration in the selection of breeding stock, as these qualities largely determine the market value. Neglect or undue exposure of the flock, a period of sickness, or anything that induces unthrift and impaired vitality invariably results in diminishing both the length and strength of fiber. Well-

fed sheep always produce the most and best wool. Softness and pliancy of wool usually correspond in degree with fineness. Harshness and dryness are always detrimental to the quality, even if the fiber is otherwise good. As a rule, this condition may be taken as an indication of poor breeding, although it may be due to disease, old age, or improper treatment. Generally, a fleece begins to decline in value and yield after a sheep becomes 4 years old. Softness and pliancy are to a considerable extent due to the secretions of the skin. A clear pink or yellowish skin is an indication of a good quality of wool, while a pale or bluish skin is generally accompanied by an inferior fleece. The yolk is the oily secretion which gives color, softness, pliancy, and luster to the fleece. The composition of the yolk consists of a soapy matter, principally animal oil and potash, which promotes the growth of the fleece and prevents friction, wearing of the fibers, and cotting. Good feeding, shelter, and care promote liberal secretion of yolk, while exposure and alkali soils result in injury to wool by diminishing the yolk. The secretions are always more abundant under high temperature, hence blanketing and confinement in close, warm quarters will stimulate the production and insure a finer fiber. A liberal secretion of yolk is favorable to the production of a good fleece, but the yolk should be clear and transparent and not too thick and gummy. In addition to these qualities, a fleece should possess the properties of evenness and uniformity; this refers to covering, density, and quality. A good fleece should be as nearly uniform in all parts as practicable. Avoid the fleeces that run to coarse, kempy fibers at the thighs and along the lower line. The best grade and quality of wool is found on the rear part of the shoulder, and the nearer all other parts of the fleece measure up to this standard in length and fineness of fiber the higher will be its value. Wrinkles or folds of the skin about the neck or other parts of the body are detrimental, as the wool that grows within these folds is unlike the others parts of the fleece, and there is a consequent lack of uniformity.

GENERAL NOTES ON SHEEP FEEDING.

The range lambs that are driven or shipped eastward to be finished on grain feeds are largely divided into two general classes—the northern coming mainly from Wyoming and Montana, and the southern from New Mexico and Arizona. Besides this there are a good many that are annually grazed in Colorado, Idaho, Utah, and other States. Large numbers, mainly from southern ranges, are fed annually in the vicinity of Fort Collins and Rocky Ford, Colo.; and at New Brighton and South St. Paul, Minn., northern range lambs are fed extensively each winter, being fattened principally upon screenings from the large mills in the vicinity of St. Paul and Minneapolis. About 200,000 head of sheep and lambs have been fed there during the past winter (1898–99). The feeders in the vicinity of Fort Collins handle about an equal number, and Rocky Ford somewhat less, although this point is rapidly

increasing in capacity for furnishing good mutton lambs in large numbers. During the winter of 1897–98 the feeders of Nebraska handled nearly 1,000,000 head; this winter (1898–99) the number is estimated at a little more than half that amount. Iowa, Illinois, and other States annually finish for market large numbers of western sheep. A total of about 2,000,000 head in all is now annually finished for market in the feed lots of the Middle and Western States.[1] The abnormally high price of range sheep and lambs for feeding purposes prevailing last summer and at the beginning of the feeding season largely reduced the number put on feed in some localities, and the past winter's experience has been somewhat disastrous to a good many feeders, particularly at New Brighton and St. Paul. This result may be attributed to two causes—namely, extreme prices paid for feeding stock and an advance of nearly 100 per cent in the price of screenings. The loss incurred, however, need not militate against the mutton-producing industry; it only serves as another illustration that unwarranted or boom prices are never safe in live-stock production of any kind. Sheep raising conducted carefully and conservatively has paid those who have been engaged in it notwithstanding the decline in prices during the past six months; it has paid the range men extremely well, and it has paid the farmer who breeds and matures his own flock; also the farmer who has bought feeders at a reasonable figure to consume his surplus farm grains. At New Brigton sheep are fattened almost exclusively on screenings that generally retail at about $4 per ton. A light grade of screenings containing less grain and more bulky coarse material is considered best at the beginning, when sheep are being put on feed, and a heavier and richer grade is used for finishing.

THE SELF-FEEDER.

The self-feeder is extensively employed where screenings are used. At other points, however, where corn constitutes the chief grain ration, the self-feeder is not in favor, and its use is not to be recommended for sheep feeding under farm conditions, though it is recommended by some successful cattle feeders. The economy of the self-feeder constituted the subject of an experiment by Prof. F. B. Mumford, of Michigan,[2] with the following results:

Results of a feeding experiment.

Method of feeding.	Lots.	Grain.	Hay.	Water.	Cost of feed.	Total gain per lamb.	Average weekly gain.	Dry matter to 1 pound gain.
		Lbs.	*Lbs.*	*Lbs.*		*Lbs.*	*Lbs.*	*Lbs.*
Ordinary	2	1,164	1,173	2,073	$14.24	23.0	1.77	8.77
Self-feed	7	1,460	924	2,547	15.47	20.6	1.58	10.04

[1] Peter Jansen. Proceedings of the National Stockmen's Convention, January, 1899.

[2] Bulletins 127, 128, Michigan Experiment Station.

The conclusions drawn concerning the use of the self-feeder at the Michigan Experiment Station are stated as follows: "Feeding by means of a self-feeder is an expensive method of fattening, and is not to be recommended either from the standpoint of total gains made or the amount of dry matter required to produce a given gain."

In Nebraska and other States, where large numbers are fed, a liberal supply of hay of good quality and at a moderate price constitutes an important factor. For this purpose perhaps nothing is superior or quite equal to properly cured alfalfa. Many large feeders have been buying extensive areas of alfalfa in Nebraska during recent years, and at other points accessible for corn feeding. Millet hay and straw are also used to a considerable extent in fattening sheep, but they are less desirable. A dry, keen, winter atmosphere is favorable to sheep feeding and conducive to general thrift of the flock and large gains; on the other hand, damp, murky weather always means unsatisfactory results.

Many of the largest feeders in Nebraska, Colorado, Minnesota, and elsewhere have no shelter, but considerable difficulty and loss are experienced in severe winters. It is generally conceded that properly constructed sheds are an advantage, though they are somewhat expensive for large feeding yards. Where the sheep are handled in smaller numbers, however, shelter is generally provided and considered profitable. A constant and liberal supply of bedding is of even greater importance than shelter, and water and salt should be accessible to fattening sheep at all times. The water supply constitutes an important factor, and any irregularity concerning it always entails loss.

REGULAR FEEDING ESSENTIAL.

Regularity and uniformity in feeding are of prime importance. Some of the most successful feeders manage a large feeding establishment with absolute regularity and precision. The system generally practiced consists in having a feeding yard separate from the other quarters. One feeding yard serves for five to ten lots of sheep ranging from three to five hundred in number. The grain ration is placed in the troughs and the sheep admitted and returned to their regular quarters in ten or fifteen minutes after the grain is eaten. The sheep themselves become wonderfully punctual and regular in their habits. When properly managed, the feeding begins at precisely the same time and proceeds in regular order each day. This procedure becomes so well understood by the sheep that they always expect their ration promptly on time, and they will take their place at the gate admitting them to the feed yard in regular order by lots. For instance, lot one at its feeding time will be waiting for admittance while lot two in the pen adjoining five minutes before feeding time will be lying contentedly and taking no notice of what is going on outside; a few minutes later, however, they will be crowded at the gate and eagerly waiting their turn. When the feeder is a quarter of an hour late, every animal in the lot seems to recognize and resent his tardiness.

Attention to these and numerous other minor details have a great deal to do with the profits resulting from extensive feeding operations. The loss from indigestion and other troubles frequently reaches 4 or 5 per cent under negligent methods, but in careful, judicious handling this can be reduced to less than 1 per cent.

Restricting the amount of grain to a very limited quantity at the beginning is absolutely essential to the best results in fattening western sheep; a lighter grain feed should then be used in preference to one that is more concentrated, and during the finishing stages a heavier and richer grain ration will be productive of good results.

FEEDING THREE TIMES A DAY.

On one of the largest and most successful feeding ranches in the West, near Jansen, Nebr., 2,500 head, in lots of about 300 each, were being fattened on a grain ration consisting of 1½ pounds of shelled corn and one-eighth of a pound of oil meal per head daily at the time of the writer's visit there in February. They were being fed grain three times daily in separate feeding yards adjoining their other quarters, according to the system previously described in this bulletin. The manager of the sheep at this farm recommends feeding three times a day, although it is not common to feed more than twice. Those who have practiced feeding three times a day claim as an advantage for this method that larger quantities of grain may be consumed with less danger of injury than by feeding only twice. One feeder who has recently introduced this method stated that he was able to safely feed 300 pounds more grain per day to 2,500 head of sheep. A striking illustration in favor of careful methods is furnished in the following record: Three lots, ranging from 500 to 1,500 each, all selected from the same large bunch shipped in from the range together, went into the hands of different feeders. One, the largest lot, made an average gain of 20 pounds in five months, another, 13, and the third, 9. They went to market at about the same time and sold for $4.55, $4.40, and $4.35, respectively. The difference in gain and value of the sheep on the market when finished was enough to return a liberal profit on the best lot, while it was with difficulty that the others were able to balance accounts. These differences prevail in other localities and demonstrate the advantage and increased profit that always result where right methods are applied. Careful feeders by giving strict attention to all essentials are able to make average gains of 8 or 10 pounds per head monthly on range lambs and 10 to 15 pounds on well-bred mutton lambs.

REQUISITES OF A GOOD SHEPHERD.

A flock of sheep can not be handled or fattened successfully without a close observance of their habits and peculiarities. There are a great many little things that enter into the attention and management by a

successful shepherd that may seem trivial, yet they have much to do with the comfort, thrift, and profit of the flock. The axiom that "The eye of the master fattens" is nowhere more applicable than in the sheep-fold. The competent feeder acquires a trained eye, that detects at a glance any evidence of disorder that will be manifest if a single animal is off of feed or out of condition. To the unobserving or inexperienced feeder sheep all look alike, but when rightly studied no class of stock presents more marked individual peculiarities or so clearly manifests evidence of thrift and well-doing or the reverse. Attention to these little details, accompanied by regular habits and a quiet manner, constitutes the keynote of successful sheep feeding. Nothing contributes more to good results than contentment and quiet surroundings. The feeder who disturbs the quiet and comfort of the flock every time he goes about it should quit the sheep business at once. Rough manners and harsh treatment absolutely disqualify any man for success in this work. The natural timidity and nervous temperament of the sheep necessitate gentle treatment. Their dainty habits about eating and drinking must also be indulged as fully as practicable. No animal naturally selects a wider variety of feed, particularly of rough forage and vegetation; but two essentials are always exacted, viz, cleanliness and palatability. Never give a sheep any stale or undesirable feed, nor expect it to eat any feed left over from a previous meal. The ration should be always wholesome and tempting to the appetite. The barn or stabling quarters should never be without a fresh, pure atmosphere and an ample supply of dry bedding. Sheep rarely suffer from cold if kept dry and protected from direct drafts. The open air is better than a poorly kept shed or barn.

WHEN IS A LAMB FAT?

It is important that the practical feeder be able to determine when lambs are properly finished and in the most satisfactory and profitable condition for the market. This is not always an easy task; experienced feeders are sometimes deceived. As an aid in studying this matter, the following directions, prepared by Prof. John A. Craig, of the animal husbandry department of the Iowa Agricultural College, for the instruction of students, are of interest:

When put into the feed lot under proper conditions, lambs will usually begin to show the influence of good feeding at the end of the third or fourth week. During this time they seem to be simply getting into good condition to put on flesh, though it appears that some flesh is being deposited internally. Toward the end of that time many of the lambs may be noticed standing leisurely in the sun in a partially stretched posture. This pose in the lambs is a delight to the shepherd. The fattening process seems to extend from the internal regions, and is first in evidence at the tail. It then passes along the back over the shoulder and reaches the neck; from this line it seems to extend down the sides and over the breast in front. There are six main points at which its extension seems most in evidence—at the tail, middle of the back, the neck, the flank, the purse, and the breast. Judges of condition

handle these different points, and seem to arrive at the same conclusions from continued practice in observing the development in any one of them, although a critical examination will reveal that lambs sometimes fatten unevenly and may be good in one or more of these points and comparatively deficient in others. By feeling the tail head some will form their opinions as to the degree to which the lamb is fat. Others are satisfied with feeling the back. Many after feeling the tail grasp the neck and base their opinion on the fullness of that part. The flank and breast are often used for further assistance, and some butchers estimate condition from the fullness of the purse. At any of these points, more especially the back, the covering should be such in the prime lamb as to prevent feeling the sharp projections of the backbone. In fact, it can hardly be said that a lamb is really prime unless instead of a projection of backbone there is a distinct trough or groove running from the tail to the shoulders, and this covering should extend well down over the sides without softness due to excessive fat or oily tissue. All lambs do not fatten as smoothly or as uniformly as herein indicated. In most lambs, however, the worst defect is bareness of the loin and lightness in the hind quarters. With these parts well covered and fully developed, a rather sharp shoulder and peaked brisket may be overlooked. Not only should the flesh be thick over the valuable cuts, but it should be firm. Very often it will be found that soft rough patches will be present about the head of the tail, owing to the depositing of too much soft flesh on the back, which may slip from there on the overripe lamb and gather at the flank or along the sides in long soft rolls.

FARMERS' BULLETINS.

These bulletins are sent free of charge to any address upon application to the Secretary of Agriculture, Washington, D. C. Only the following are available for distribution:

No. 15. Some Destructive Potato Diseases: What They Are and How to Prevent Them. No. 16. Leguminous Plants for Green Manuring and for Feeding. No. 18. Forage Plants for the South. No. 19. Important Insecticides: Directions for their Preparation and Use. No. 21. Barnyard Manure. No. 22. Feeding Farm Animals. No. 23. Foods: Nutritive Value and Cost. No. 24. Hog Cholera and Swine Plague. No. 25. Peanuts: Culture and Uses. No. 26. Sweet Potatoes: Culture and Uses. No. 27. Flax for Seed and Fiber. No. 28. Weeds; and How to Kill Them. No. 29. Souring of Milk and Other Changes in Milk Products. No. 30. Grape Diseases on the Pacific Coast. No. 31. Alfalfa, or Lucern. No. 32. Silos and Silage. No. 33. Peach Growing for Market. No. 34. Meats: Composition and Cooking. No. 35. Potato Culture. No. 36. Cotton Seed and Its Products. No. 37. Kafir Corn: Characteristics, Culture, and Uses. No. 38. Spraying for Fruit Diseases. No. 39. Onion Culture. No. 40. Farm Drainage. No. 41. Fowls: Care and Feeding. No. 42. Facts About Milk. No. 43. Sewage Disposal on the Farm. No. 44. Commercial Fertilizers. No. 45. Some Insects Injurious to Stored Grain. No. 46. Irrigation in Humid Climates. No. 47. Insects Affecting the Cotton Plant. No. 48. The Manuring of Cotton. No. 49. Sheep Feeding. No. 50. Sorghum as a Forage Crop. No. 51. Standard Varieties of Chickens. No. 52. The Sugar Beet. No. 53. How to Grow Mushrooms. No. 54. Some Common Birds in Their Relation to Agriculture. No. 55. The Dairy Herd: Its Formation and Management. No. 56. Experiment Station Work—I. No. 57. Butter Making on the Farm. No. 58. The Soy Bean as a Forage Crop. No. 59. Bee Keeping. No. 60. Methods of Curing Tobacco. No. 61. Asparagus Culture. No. 62. Marketing Farm Produce. No. 63. Care of Milk on the Farm. No. 64. Ducks and Geese. No. 65. Experiment Station Work—II. No. 66. Meadows and Pastures. No. 67. Forestry for Farmers. No. 68. The Black Rot of the Cabbage. No. 69. Experiment Station Work—III. No. 70. The Principal Insect Enemies of the Grape. No. 71. Some Essentials of Beef Production. No. 72. Cattle Ranges of the Southwest. No. 73. Experiment Station Work—IV. No. 74. Milk as Food. No. 75. The Grain Smuts. No. 76. Tomato Growing. No. 77. The Liming of Soils. No. 78. Experiment Station Work—V. No. 79. Experiment Station Work—VI. No. 80. The Peach Twig-borer—an Important Enemy of Stone Fruits. No. 81. Corn Culture in the South. No. 82. The Culture of Tobacco. No. 83. Tobacco Soils. No. 84. Experiment Station Work—VII. No. 85. Fish as Food. No. 86. Thirty Poisonous Plants. No. 87. Experiment Station Work—VIII. No. 88. Alkali Lands. No. 89. Cowpeas. No. 90. The Manufacture of Sorghum Sirup. No. 91. Potato Diseases and Their Treatment. No. 92. Experiment Station Work—IX. No. 93. Sugar as Food. No. 94. The Vegetable Garden. No. 95. Good Roads for Farmers (in press).